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ASCIDIACEA

by

R. H. Millar

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By

R. H. MILLAR

Marine Station, Millport

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ASCIDIACEA

By R. H. Millar
Marine Station, Millport

(Plates I–VI, text-figs. 1–72)

INTRODUCTION

THE ascidians which this report describes were collected during the years 1925–37 by R.R.S. 'Discovery', R.R.S. 'Discovery II', R.R.S. 'William Scoresby', and the staff of the Marine Biological Station at South Georgia. A large part of the material is from the Falkland Islands and Patagonian shelf in the Subantarctic, and much was also collected from the vicinity of Graham Land, South Georgia and the South Shetland, South Orkney, and South Sandwich Islands in the Weddell Sea sector of the Antarctic. Of the many other localities represented, one of the most interesting is the Three Kings district at the northern end of New Zealand.

There are altogether about 2500 specimens, representing seventy-eight identifiable species. Of these, thirteen are described as new and there are three new *forms* of known species. The type specimens are deposited in the British Museum (Nat. Hist.).

LIST OF NEW GENERA, SPECIES AND FORMS

Aplidium falklandicum sp.n.
A. stanleyi sp.n.
A. quadrisulcatum sp.n.
A. seeligeri sp.n.
Aplidiopsis discoveryi sp.n.
Protopolyclinum gen.n.
P. pedunculatum sp.n.
Ritterella vestita sp.n.
Didemnum trivolutum sp.n.
Podoclavella kottae sp.n.
Sycozoa anomala sp.n.
Cnemidocarpa tricostata sp.n.
Styela schmitti f. *simplex* n.
Molgula setigera f. *georgiana* n.
,, ,, f. *marioni* n.
Eugyra brewinae sp.n.
E. ärnbäckae sp.n.

The task of working through the material was greatly eased by the fact that Dr A. Ärnbäck-Christie-Linde had completed the process of sorting the collection before her death. She also made preliminary identifications of a number of the specimens and left notes on some of them. Her notes, which were made available to me, have been very valuable. Nevertheless, I have had to re-examine all the material, and this report represents my own views, which differ in many points from those which Dr Ärnbäck-Christie-Linde would have expressed had she lived to write the account of the Ascidiacea from the 'Discovery' collections.

CLASSIFICATION

I have adopted the classification used by Huus (1937–40) in Kükenthal and Krumbach's *Handbuch der Zoologie*, with the following modifications:

In the order Enterogona, suborder Phlebobranchiata I have recognized the family Diazonidae Garstang, 1891, as distinct from the family Cionidae Lahille, 1887, using these groups as defined by Berrill (1950). *Ciona* occupies a somewhat isolated and probably primitive position, indicated especially by the failure of the two epicardia to fuse and by the position of the gut (Berrill, 1936), and therefore merits a family to distinguish it from the diazonids (*Diazona*, *Tylobranchion*, *Rhopalea*).

In the order Pleurogona, suborder Stolidobranchiata, I have again followed Berrill (1950), who gave convincing reasons for dividing the family Styelidae Sluiter, 1895, into two subfamilies only, Botryllinae Adams, 1858, and Styelinae Herdman, 1881, although Huus and others have recognized a third subfamily Polyzoinae Hartmeyer 1903.

Two minor points in which the present classification differs from that of Huus concern the genera *Herdmania* Lahille, 1887, and *Bathypera* Michaelsen, 1904. I have used the generic name *Herdmania* for the species *H. momus* (Savigny), although Huus used it for a polyclinid species generally referred to as *Euherdmania claviformis* (Ritter). The generic name *Herdmania* was preoccupied when Ritter (1903) proposed it, as he himself later recognized (Ritter, 1904).

The position of *Bathypera* is still doubtful, and although Huus placed this genus in the family Molgulidae, I believe that a number of characters show it to be better placed in the family Pyuridae.

SYSTEMATIC LIST OF SPECIES IN THE COLLECTION

Order *ENTEROGONA* Perrier, 1898

Suborder APLOUSOBRANCHIATA Lahille, 1886

Family POLYCLINIDAE Verrill, 1871

Subfamily POLYCLININAE Adams, 1858

Genus **Aplidium** Savigny, 1816

A. circumvolutum (Sluiter)
A. fuegiense Cunningham
A. variabile (Herdman)
A. falklandicum sp.n.
A. radiatum (Sluiter)
A. caeruleum (Sluiter)
A. stanleyi sp.n.
A. quadrisulcatum sp.n.
A. seeligeri sp.n.

Genus **Synoicum** Phipps, 1774

S. adareanum (Herdman)
S. georgianum Sluiter
S. giardi (Herdman)
S. kuranui Brewin

Genus **Aplidiopsis** Lahille, 1890

A. discoveryi sp.n.

Genus **Protopolyclinum** gen.n.

P. pedunculatum sp.n.

Subfamily EUHERDMANIINAE Seeliger, 1906

Genus **Ritterella** Harant, 1931

R. vestita sp.n.

Family DIDEMNIDAE Giard, 1872

Genus **Didemnum** Savigny, 1816

D. studeri Hartmeyer
D. biglans (Sluiter)
D. trivolutum sp.n.

Genus **Leptoclinides** Bjerkan, 1905

L. diemenensis Michaelsen

Genus **Trididemnum** Della Valle, 1881

T. auriculatum Michaelsen

Family CLAVELINIDAE Forbes & Hanley, 1848

Subfamily CLAVELININAE Seeliger, 1906

Genus **Podoclavella** Herdman, 1890

P. cylindrica (Quoy & Gaimard) *P. kottae* sp.n.

Genus **Clavelina** Savigny, 1816

C. claviformis (Herdman)

Subfamily POLYCITORINAE Michaelsen, 1904

Genus **Sycozoa** Lesson, 1830

S. sigillinoides Lesson *S. anomala* sp.n.

S. georgiana (Michaelsen)

Genus **Distaplia** Della Valle, 1881

D. colligans Sluiter *D. cylindrica* (Lesson)

Genus **Hypsistozoa** Brewin, 1953

H. fasmeriana (Michaelsen)

Genus **Cystodytes** van Drasche, 1883

C. dellechiajei (Della Valle) *C. dellechiajei* f. *antarctica* (Sluiter)

Genus **Atapozoa** Brewin, 1956

A. marshi Brewin

Suborder PHLEBOBRANCHIATA Lahille, 1886

Family DIAZONIDAE Garstang, 1891

Genus **Tylobranchion** Herdman, 1886

T. speciosum Herdman

Family ASCIDIIDAE Adams, 1858

Genus **Ascidia** Linnaeus, 1767

A. translucida Herdman *A. interrupta* Heller

A. challengeri Herdman *A. sydneiensis* Stimpson

Family AGNESIIDAE Huntsman, 1912

Genus **Agnesia** Michaelsen, 1898

A. glaciata Michaelsen

Genus **Caenagnesia** Ärnbäck, 1938

C. bocki Ärnbäck

Family CORELLIDAE Lahille, 1887

Subfamily CORELLINAE Herdman, 1882

Genus **Corella** Alder & Hancock, 1870

C. eumyota Traustedt

Order *PLEUROGONA* Perrier, 1898

Suborder STOLIDOBRANCHIATA Lahille, 1886

Family STYELIDAE Sluiter, 1895

Subfamily BOTRYLLINAE Adams, 1858

Genus **Botryllus** Gaertner, 1774

?*B. separatus* Sluiter

Genus **Polyzoa** Lesson, 1830

P. opuntia Lesson

P. reticulata (Herdman)

Genus **Alloeocarpa** Michaelsen, 1900

A. incrustans (Herdman)

Genus **Amphicarpa** Michaelsen, 1922

A. diptycha (Hartmeyer)

Subfamily STYELINAE Herdman, 1881

Genus **Cnemidocarpa** Huntsman, 1912

C. pfefferi (Michaelsen)

C. nordenskjöldi (Michaelsen)

C. drygalskii (Hartmeyer)

C. verrucosa (Lesson)

C. tricostata sp.n.

Genus **Styela** Fleming, 1822

S. schmitti van Name f. *simplex* n.

S. insinuosa (Sluiter)

S. magalhaensis Michaelsen

S. paessleri Michaelsen

S. partita (Stimpson)

Family PYURIDAE Hartmeyer, 1908

Genus **Pyura** Molina, 1782

P. stolonifera (Heller)

P. setosa (Sluiter)

P. discoveryi (Herdman)

P. squamata Hartmeyer

P. legumen (Lesson)

P. georgiana (Michaelsen)

P. bouvetensis (Michaelsen)

P. jacatrensis (Sluiter)

P. vittata (Stimpson)

Genus **Herdmania** Lahille, 1887

H. momus (Savigny)

Genus **Bathypera** Michaelsen, 1904

B. splendens Michaelsen

Family MOLGULIDAE Lacaze-Duthiers, 1877

Genus **Molgula** Forbes & Hanley, 1848

M. pedunculata Herdman

M. falsensis Millar

M. platei Hartmeyer

M. malvinensis Ärnbäck

M. bacca Herdman

M. setigera Ärnbäck f. *georgiana* n.

M. setigera Ärnbäck f. *marioni* n.

M. sabulosa (Quoy & Gaimard)

Genus **Ascopera** Herdman, 1881
A. gigantea Herdman

Genus **Paramolgula** Traustedt, 1885
P. gregaria (Lesson)

Genus **Eugyra** Alder & Hancock, 1870
E. kerguelenensis Herdman
E. ärnbäckae sp.n.
E. brewinae sp.n.

LIST OF STATIONS AND SPECIES COLLECTED AT EACH R.R.S. 'DISCOVERY'

Station 1. 16. xi. 25. Clarence Bay, Ascension Island, 7° 55′ 15″ S., 14° 25′ W. Medium rectangular net, coralline, sand and shells, 16–27 m.
Pyura vittata (Stimpson). 1 specimen.

Station 2. 17. xi. 25. Clarence Bay, Ascension Island, St Catherine's Pt. and Collyer Pt. Shore collection.
Styela partita (Stimpson). 2 specimens.

Station 27. 15. iii. 26. West Cumberland Bay, South Georgia; 3·3 miles S. 44° E. of Jason Lt. Large dredge, mud and rock, 110 m.
?*Aplidium fuegiense* Cunningham. 1 specimen.
A. radiatum (Sluiter). 2 specimens.
Cnemidocarpa tricostata sp.n. 1 specimen.
Pyura discoveryi (Herdman). 29 specimens.
Molgula pedunculata Herdman. 23 specimens.

Station 39. 25. iii. 26. East Cumberland Bay, South Georgia. From 8 cables S. 81° W. of Merton Rock to 1·3 miles N. 7° E. of Macmahon Rock. Large otter trawl, grey mud, 179–235 m.
Aplidium circumvolutum (Sluiter). 1 specimen.
Sycozoa georgiana (Michaelsen). 5 specimens.
Distaplia cylindrica (Lesson). 2 specimens.
Ascidia translucida Herdman. 1 specimen.
Cnemidocarpa verrucosa (Lesson). 4 specimens.
Pyura georgiana Michaelsen. 2 specimens.
Molgula pedunculata Herdman. 7 specimens.
Ascopera gigantea Herdman. 2 specimens.

Station 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia. From 6·3 miles N. 89° E. to 4 miles N. 39° E. of Jason Lt. Large otter trawl, mud, 120–204 m.
Caenagnesia bocki Ärnbäck. 1 specimen.
Polyzoa reticulata (Herdman). 1 specimen.
Cnemidocarpa pfefferi (Michaelsen). 1 specimen.
C. verrucosa (Lesson). 1 specimen.
Pyura discoveryi (Herdman). 44 specimens.
P. georgiana Michaelsen. 4 specimens.
Molgula pedunculata Herdman. 2 specimens.
Ascopera gigantea Herdman. 8 specimens.

Station 45. 6. iv. 26. 2·7 miles S. 85° E. of Jason Lt., South Georgia. Large otter trawl, grey mud, 238–270 m.
Sycozoa sigillinoides Lesson. 3 specimens.
Distaplia cylindrica (Lesson). 1 specimen.
Cnemidocarpa verrucosa (Lesson). 7 specimens.
Molgula pedunculata Herdman. 10 specimens.
Ascopera gigantea Herdman. 24 specimens.

Station 48. 3. v. 26. 8·3 miles N. 53° E. of William Pt. Beacon, Port William, Falkland Islands. Large otter trawl, sand and shell, 105–115 m.
Alloeocarpa incrustans (Herdman). 1 specimen.

Station 51. 4. v. 26. Off Eddystone Rock, East Falkland Island. From 7 miles N. 50° E. to 7·6 miles N. 63° E. of Eddystone Rock. Large otter trawl, fine sand, 105–115 and 115 m.

Aplidium fuegiense Cunningham. 1 specimen.
A. falklandicum sp.n. 2 specimens.
Sycozoa sigillinoides Lesson. 7 specimens.
Cnemidocarpa verrucosa (Lesson). 1 specimen.
Polyzoa reticulata (Herdman). 1 specimen.
Alloeocarpa incrustans (Herdman). 2 specimens.
Paramolgula gregaria (Lesson). 1 specimen.

Station 52. 5. v. 26. Port William, East Falkland Island, 7·4 cables N. 17° E. of Navy Pt. Hand lines, 17 m.

Alloeocarpa incrustans (Herdman). 1 specimen.
Pyura legumen (Lesson). 4 specimens.
Paramolgula gregaria (Lesson). 1 specimen.

Station 53. 12. v. 26. Port Stanley, East Falkland Island. Hulk of 'Great Britain'. Mussel rake, 0–2 m.

Aplidium falklandicum sp.n. 1 specimen.
Sycozoa sigillinoides Lesson. 28 specimens.
Cnemidocarpa nordenskjöldi (Michaelsen). 4 specimens.
C. verrucosa (Lesson). 7 specimens.
Styela paessleri Michaelsen. 4 specimens.
Pyura legumen (Lesson). 1 specimen.
Paramolgula gregaria (Lesson). 9 specimens.

Station 55. 16. v. 26. Entrance to Port Stanley, East Falkland Island, 2 cables S. 24° E. of Navy Pt. Small beam trawl, 10–16 m.

Corella eumyota Traustedt. 4 specimens.
Cnemidocarpa verrucosa (Lesson). 4 specimens.
Alloeocarpa incrustans (Herdman). 1 specimen.
Pyura legumen (Lesson). 1 specimen.
Paramolgula gregaria (Lesson). 2 specimens.

Station 56. 16. v. 26. Sparrow Cove, Port William, East Falkland Island, 1·5 cables N. 50° E. of Sparrow Pt. Small beam trawl, 10·5–16 m.

Didemnum studeri Hartmeyer. 2 specimens.
Alloeocarpa incrustans (Herdman). 3 specimens.
Pyura legumen (Lesson). 7 specimens.
Paramolgula gregaria (Lesson). 1 specimen.

Station 57. 16. v. 26. Port William, East Falkland Island, 5·5 cables S. 20° W. of Sparrow Pt. Small beam trawl, 15 m.

Pyura legumen (Lesson). 2 specimens.
Paramolgula gregaria (Lesson).

Station 58. 19. v. 26. Port Stanley, East Falkland Island. Mussel rake, 1–2 m.

Polyzoa reticulata (Herdman). 13 specimens.
Alloeocarpa incrustans (Herdman). 1 specimen.
Cnemidocarpa verrucosa (Lesson). 32 specimens.
Paramolgula gregaria (Lesson). 3 specimens.

Station 90. 10. vii. 26. Simon's Town, False Bay, South Africa. Basin of H.M. Dockyard. Hand net, 0–2 m.

Ascidia sydneiensis Stimpson. 1 specimen.
Pyura stolonifera (Heller). 2 specimens.

Station 91. 8. ix. 26. 0·5 mile off Roman Rock, False Bay, South Africa. Small rectangular net, sand, 35 m.

Agnesia glaciata Michaelsen. 1 specimen.
Molgula falsensis Millar. 6 specimens.

Station 123. 15. xii. 26. Off mouth of Cumberland Bay, South Georgia. From 4·1 miles N. 54° E. of Larsen Pt. to 1·2 miles S. 62° W. of Merton Rock. Large otter trawl, grey mud, 230–250 m.

Distaplia cylindrica (Lesson). 4 specimens.
Tylobranchion speciosum Herdman. 1 specimen.
Cnemidocarpa pfefferi (Michaelsen). 1 specimen.
C. verrucosa (Lesson). 1 specimen.
?Styela magalhaensis Michaelsen. 2 specimens.
Pyura georgiana Michaelsen. 8 specimens.
Molgula pedunculata Herdman. 20 specimens.
Ascopera gigantea Herdman. 5 specimens.

Station 140. 23. xii. 26. Stromness Harbour to Larsen Pt., South Georgia. From 54° 02′ S., 36° 38′ W. to 54° 11′ 30″ S., 36° 29′ W. Large otter trawl, green mud and stones, 122–136 m.

Synoicum georgianum Sluiter. 1 specimen.
Sycozoa georgiana (Michaelsen). 1 specimen.
Distaplia cylindrica (Lesson). 1 specimen.
Polyzoa reticulata (Herdman). 1 specimen.
Cnemidocarpa verrucosa (Lesson). 1 specimen.
Pyura discoveryi (Herdman). 42 specimens.
P. georgiana Michaelsen. 5 specimens.
Molgula pedunculata Herdman. 5 specimens.
Ascopera gigantea Herdman. 2 specimens.

Station 141. 29. xii. 26. East Cumberland Bay, South Georgia, 200 yards from shore, under Mt. Druse. Small beam trawl, mud, 17–27 m.

Polyzoa reticulata (Herdman). 2 specimens.
Alloeocarpa incrustans (Herdman). 1 specimen.

Station 142. 30. xii. 26. East Cumberland Bay, South Georgia. From 54° 11′ 30″ S., 36° 35′ W. to 54° 12′ S., 36° 29′ 30″ W. Large otter trawl, mud, 88–273 m.

Distaplia cylindrica (Lesson). 1 specimen.

Station 143. East Cumberland Bay, South Georgia. 54° 12′ S., 36° 29′ 30″ W. Large otter trawl, mud, 273 m.

Cnemidocarpa verrucosa (Lesson). 1 specimen.

Station 144. 5. i. 27. Off mouth of Stromness Harbour, South Georgia. From 54° 04′ S., 36° 27′ W. to 53° 58′ S., 36° 26′ W. Large otter trawl, green mud and sand, 155–178 m.

Synoicum georgianum Sluiter. 3 specimens.
Tylobranchion speciosum Herdman. 5 specimens.
Pyura discoveryi (Herdman). 25 specimens.
P. georgiana Michaelsen. 5 specimens.
Molgula pedunculata Herdman. 7 specimens.

Station 145. 7. i. 27. Stromness Harbour, South Georgia. Between Grass Island and Tonsberg Pt. Small beam trawl, 26–35 m.

Sycozoa sigillinoides Lesson. 8 specimens.
Ascidia challengeri Herdman. 1 specimen.
Polyzoa opuntia Lesson. 1 specimen.
Alloeocarpa incrustans (Herdman). 2 specimens.
Pyura georgiana Michaelsen. 1 specimen.

Station 148. 9. i. 27. Off Cape Saunders, South Georgia. From 54° 03′ S., 36° 39′ W. to 54° 05′ S., 36° 36′ 30″ W. Large otter trawl, grey mud and stones, 132–148 m.

Distaplia cylindrica (Lesson). 4 specimens.
Polyzoa reticulata (Herdman). 1 specimen.
Cnemidocarpa verrucosa (Lesson). 2 specimens.
Pyura discoveryi (Herdman). 10 specimens.
P. georgiana Michaelsen. 1 specimen.

Station 149. 10. i. 27. Mouth of East Cumberland Bay, South Georgia. From 1·15 miles N. 76½° W. to 2·62 miles S. 11° W. of Merton Rock. Large otter trawl, mud, 200–234 m.

Synoicum georgianum Sluiter. 1 specimen.
Sycozoa georgiana (Michaelsen). 3 specimens.
Distaplia cylindrica (Lesson). 1 specimen.

Station 152. 17. i. 27. 53° 51′ 30″ S., 36° 18′ 30″ W. Large dredge, rock, 245 m.

Pyura discoveryi (Herdman). 3 specimens.
P. georgiana Michaelsen. 1 specimen.
Ascopera gigantea Herdman. 1 specimen.

Station 156. 20. i. 27. 53° 51′ S., 36° 21′ 30″ W. Large dredge, rock, 200–236 m.

Ascidia challengeri Herdman. 3 specimens.
Styela insinuosa (Sluiter). 1 specimen.
Pyura georgiana Michaelsen. 1 specimen.
Ascopera gigantea Herdman. 1 specimen.

Station 159. 21. i. 27. 53° 52′ 30″ S., 36° 08′ W. Large dredge, rock, 160 m.

Cnemidocarpa pfefferi (Michaelsen). 1 specimen.
C. verrucosa (Lesson). 4 specimens.
Pyura discoveryi (Herdman). 10 specimens.
Molgula malvinensis Ärnbäck. 3 specimens.
M. setigera Ärnbäck f. *georgiana* n. 4 specimens.
Ascopera gigantea Herdman. 1 specimen.

Station 160. 7. ii. 27. Near Shag Rocks, 53° 43′ 40″ S., 40° 57′ W. Large dredge, stones and rock, 177 m.

Aplidium variabile (Herdman). 21 specimens.
Tylobranchion speciosum Herdman. 2 specimens.
Ascidia challengeri Herdman. 2 specimens.
Cnemidocarpa verrucosa (Lesson). 1 specimen.
Pyura discoveryi (Herdman). 2 specimens.
Molgula pedunculata Herdman. 1 specimen.

Station 164. 18. ii. 27. East end of Normanna Strait, South Orkneys, near C. Hansen, Coronation Island. Small beam trawl, 24–36 m.

Aplidium radiatum (Sluiter). 1 specimen.
A. falklandicum sp.n. 7 specimens.
Distaplia colligans Sluiter. 1 specimen.
Ascidia challengeri Herdman. 2 specimens.

Station 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 61° 25′ 30″ S., 53° 46′ W. Large dredge, rock, 342 m.

Aplidium circumvolutum (Sluiter). 4 specimens.
Pyura discoveryi (Herdman). 1 specimen.
P. bouvetensis (Michaelsen). 8 specimens.

Station 175. 2. iii. 27. Bransfield Strait, South Shetlands, 63° 17′ 20″ S., 59° 48′ 15″ W. Large dredge, mud, stones and gravel, 200 m.

Aplidium circumvolutum (Sluiter). 1 specimen.
Synoicum adareanum (Herdman). 2 specimens.
Pyura setosa (Sluiter). 1 specimen.
Molgula bacca Herdman. 1 specimen.

Station 177. 5. iii. 27. 27 miles south-west of Deception I., South Shetlands. 63° 17′ 30″ S., 61° 17′ W. Large dredge, mud, coarse sand and stones, 1080 m.

Pyura discoveryi (Herdman). 1 specimen.

Station 181. 12. iii. 27. Schollaert Channel, Palmer Archipelago, 64° 20′ S., 63° 01′ W. Large otter trawl, mud, 160–335 m.

Aplidium radiatum (Sluiter). 6 specimens.
Cystodytes dellechiajei f. *antarctica* (Sluiter). 1 specimen.
Caenagnesia bocki Ärnbäck. 1 specimen.
Pyura bouvetensis (Michaelsen). 2 specimens.
Bathypera splendens Michaelsen. 1 specimen.

Station 182. 14. iii. 27. Schollaert Channel, Palmer Archipelago, 64° 21′ S., 62° 58′ W. Large otter trawl, mud, 278–500 m.

Didemnum biglans (Sluiter). 1 specimen.
Caenagnesia bocki Ärnbäck. 4 specimens.

Station 186. 16. iii. 27. Fournier Bay, Anvers Island, Palmer Archipelago, 64° 25′ 30″ S., 63° 02′ W. Large dredge, mud, 295 m.

Aplidium radiatum (Sluiter). 1 specimen.

Station 187. 18. iii. 27. Neumayr Channel, Palmer Archipelago, 64° 48′ 30″ S., 63° 31′ 30″ W. Large otter trawl, mud, 259–354 m.

Didemnum biglans (Sluiter). 1 specimen.
Cnemidocarpa drygalskii (Hartmeyer). 3 specimens.
Pyura discoveryi (Herdman). 1 specimen.
P. squamata Hartmeyer. 1 specimen.
P. bouvetensis (Michaelsen). 49 specimens.

Station 189. 23. iii. 27. Port Lockroy, Wienke Island, Palmer Archipelago. Hand net, 0 m.

Distaplia cylindrica (Lesson). 1 specimen.

Station 190. 24. iii. 27. Bismarck Strait, Palmer Archipelago, 64° 56′ S., 65° 35′ W. Large dredge, stones, mud and rock, 93–126, and 315 m.

Aplidium circumvolutum (Sluiter). 3 specimens.
A. radiatum (Sluiter). 3 specimens.
A. caeruleum (Sluiter). 1 specimen.
Cystodytes dellechiajei f. *antarctica* (Sluiter). 1 specimen.
Cnemidocarpa verrucosa (Lesson). 1 specimen.
Pyura discoveryi (Herdman). 1 specimen.
P. bouvetensis (Michaelsen). 8 specimens.
Molgula pedunculata Herdman. 1 specimen.

Station 195. 30. iii. 27. Admiralty Bay, King George Island, South Shetlands, 62° 07′ S., 58° 28′ 30″ W. Medium otter trawl, mud and stones, 391 m.

Ascidia challengeri Herdman. 6 specimens.
Pyura bouvetensis (Michaelsen). 3 specimens.
Ascopera gigantea Herdman. 1 specimen.

Station 279. 10. vii. 27. Off Cape Lopez, French Congo. From 8·5 miles N. 71° E. to 15 miles N. 24° E. of Cape Lopez Lt. Large otter trawl, mud and fine sand, 58–67 m.

Ascidia interrupta Heller. 3 specimens.

Station 363. 26. ii. 30. 2·5 miles S. 80° E. of S.E. point of Zavodovski Island, South Sandwich Islands. Large dredge, 329–278 m.

?*Sycozoa georgiana* (Michaelsen). 7 specimens.

Station 366. 6. iii. 30. 4 cables south of Cook Island, South Sandwich Islands. Large dredge, black sand, 155–322 m.

Distaplia cylindrica (Lesson). 7 specimens.
Cnemidocarpa verrucosa (Lesson). 10 specimens.
Ascopera gigantea Herdman. 27 specimens.
Eugyra ärnbäckae sp.n. 46 specimens.

Station 370. 10. iii. 30. 2 miles north-east of Bristol Island, South Sandwich Islands. Large otter trawl, 18–80 m.

Cnemidocarpa verrucosa (Lesson). 1 specimen.

Station 371. 14. iii. 30. 1 mile east of Montagu Island, South Sandwich Islands. Large otter trawl, 99–161 m.

Tylobranchion speciosum Herdman. 2 specimens.
Cnemidocarpa verrucosa (Lesson). 1 specimen.
Ascopera gigantea Herdman. 5 specimens.

Station 388. 16. iv. 30. 56° 19′ 30″ S., 67° 09′ 45″ W. Large dredge, 121 m.

Styela schmitti van Name f. *simplex* n. 6 specimens.
Alloeocarpa incrustans (Herdman). 35 specimens.

Station 399. 18. v. 30. 1 mile S.E. of S.W. point of Gough Island. Large dredge, 141–102 m.

Didemnum studeri Hartmeyer. 1 specimen.

Station 474. 12. xi. 30. 1 mile west of Shag Rocks, South Georgia. Large dredge, 199 m.

Synoicum georgianum Sluiter. 1 specimen.
Polyzoa reticulata (Herdman). 1 specimen.
Alloeocarpa incrustans (Herdman). 2 specimens.
Cnemidocarpa verrucosa (Lesson). 1 specimen.
Styela insinuosa (Sluiter). 2 specimens.
Pyura discoveryi (Herdman). 11 specimens.
Molgula malvinensis Ärnbäck. 2 specimens.
M. setigera Ärnbäck f. *georgiana* n. 1 specimen.

Station 476. 12. xi. 30. 1 mile north of Shag Rocks, South Georgia. 1 m. tow-net, 165–0 m. (net touched bottom).

Distaplia colligans Sluiter. 1 specimen.

Station 599. 17. i. 31. 67° 08′ S., 69° 06′ 30″ W. Large dredge, 203 m.

Cnemidocarpa verrucosa (Lesson). 1 specimen.
Pyura bouvetensis (Michaelsen). 1 specimen.
Molgula pedunculata Herdman. 1 specimen.

Station 600. 17. i. 31. 67° 09′ S., 69° 27′ W. Large otter trawl, 501–527 m.

Pyura bouvetensis (Michaelsen). 3 specimens.

Station 652. 14. iii. 31. Burdwood Bank, 54° 04′ S., 61° 40′ W. Large otter trawl, 171–169 m. Large dredge, 164 m.

Aplidium fuegiense Cunningham. 1 specimen.
A. falklandicum sp.n. 3 specimens.
Sycozoa sigillinoides Lesson. 1 specimen.

Station 929. 16. viii. 32. 34° 21′ S., 172° 48′ E. to 34° 22′ S., 172° 49′ 48″ E. Large otter trawl, 58–55 m.

Sycozoa anomala sp.n. 4 specimens.
Clavelina claviformis (Herdman). 2 specimens.

Station 934. 17. vii. 32. 34° 11′ 36″ S., 172° 10′ 54″ E. to 34° 11′ 24″ S., 172° 10′ 18″ E. Large otter trawl, 98–92 m.

Protopolyclinum pedunculatum gen.n., sp.n. 4 specimens.
Ritterella vestita sp.n. 1 specimen.
Podoclavella kottae sp.n. 1 specimen.
Cystodytes dellechiajei (Della Valle). 4 specimens.
?*Botryllus separatus* Sluiter. 1 specimen.

Station 935. 17. viii. 32. 34° 11′ 30″ S., 172° 08′ 30″ E. to 34° 11′ 54″ S., 172° 08′ 30″ E. Large dredge, 84 m.

?*Aplidium quadrisulcatum* sp.n. 4 specimens.
A. seeligeri sp.n. 1 specimen.
Synoicum kuranui Brewin. 6 specimens.
Leptoclinides diemenensis Michaelsen. 1 specimen.
Hypsistozoa fasmeriana (Michaelsen). 1 specimen.
Atapozoa marshi Brewin. 2 specimens.
Cystodytes dellechiajei (Della Valle). 3 specimens.

Station 936. 18. viii. 32. 35° 03′ 30″ S., 172° 58′ 12″ E. to 35° 05′ 24″ S., 172° 58′ 42″ E. Large otter trawl, 50–57 m.

Eugyra brewinae sp.n. 17 specimens.

Station 939. 18. viii. 32. 35° 49′ 36″ S., 173° 27′ E. to 35° 51′ 36″ S., 173° 28′ 54″ E. Large otter trawl, 87 m.

Aplidium quadrisulcatum sp.n. 5 specimens.
Agnesia glaciata Michaelsen. 4 specimens.

Station 941. 20. viii. 32. 40° 51′ 24″ S., 174° 48′ 12″ E. to 40° 55′ 48″ S., 174° 46′ 42″ E. Large dredge, 128 m.

Aplidium seeligeri sp.n. 1 specimen.
Aplidiopsis discoveryi sp.n. 1 specimen.

Station 1113. 5. ii. 33. 63° 04′ 30″ S., 62° 15′ W. Tow-net, 275–130 m.

Distaplia colligans Sluiter. 1 specimen.

Station 1159. 17. iii. 33. 55° 48′ 42″ S., 14° 45′ 12″ E. Tow-net, 230–0 m.

Cnemidocarpa verrucosa (Lesson). 1 specimen.

Station 1230. 23. xii. 33. 6·7 miles N. 62° W. from Dungeness Lt., Magellan Strait. Russell's bottom tow-net, 27 m.

Sycozoa sigillinoides Lesson. 5 specimens.
Polyzoa opuntia Lesson. 13 specimens.
P. reticulata (Herdman). 1 specimen.
Alloeocarpa incrustans (Herdman). 1 specimen.
Paramolgula gregaria (Lesson). 4 specimens.

Station 1563. 7. iv. 35. 46° 48′ 24″ S., 37° 49′ 12″ E. Large dredge, 113–99 m. and 101–106 m.

?*Aplidium caeruleum* (Sluiter). 1 specimen.
Pyura jacatrensis (Sluiter). 1 specimen.
Molgula setigera Ärnbäck f. *marioni* n. 1 specimen.

Station 1652. 23. i. 36. 75° 56′ 12″ S., 178° 35′ 30″ W. Harvey's phytoplankton net, 567 m.

Ascidia challengeri Herdman. 3 specimens.
Corella eumyota Traustedt. 2 specimens.

Station 1660. 27. i. 36. 74° 46′ 24″ S., 178° 23′ 24″ E. Large otter trawl, 351 m.

Synoicum adareanum (Herdman). 5 specimens.
Ascidia challengeri Herdman. 1 specimen.

Station 1686. 4. iii. 36. 38° 16′ 6″ S., 144° 40′ 12″ E. Queenscliffe Jetty, Port Philip, Victoria, Australia. Mussel rake, 0 m.

Podoclavella cylindrica (Quoy & Gaimard). 1 specimen.
Herdmania momus (Savigny). 1 specimen.
Ascidia sydneiensis Stimpson. 1 specimen.
Molgula sabulosa (Quoy & Gaimard). 1 specimen.
Amphicarpa diptycha (Hartmeyer). 1 specimen.

Station 1873. 13. xi. 36. 61° 20′ 48″ S., 54° 04′ 12″ W. Russell rectangular dredge, 210–180 m.

Ascopera gigantea Herdman. 1 specimen.

Station 1900. 27–28. xi. 36. 49° 49′ 30″ S., 66° 14′ 24″ W. to 49° 49′ 24″ S., 66° 14′ 48″ W. 1 m. tow-net, 0–5 m.

Distaplia cylindrica (Lesson). 1 specimen.

Station 1902. 28. xi. 36. 49° 48′ S., 67° 39′ 30″ W. 4 miles S. 32° E. of Cape San Fransisco de Paula Lt. Large otter trawl, 50–80 m.

Aplidium falklandicum sp.n. 4 specimens.
Paramolgula gregaria (Lesson). 4 specimens.
Polyzoa opuntia Lesson. 13 specimens.

Station 1906. 29–30. xi. 36. 53° 54′ 36″ S., 63° 58′ 6″ W. 1 m. tow-net, 0–5 m.

Distaplia cylindrica (Lesson). 2 specimens.

Station 1941. 29. xii. 36. Leith Harbour, South Georgia. Small dredge, 38 and 55–22 m.

Synoicum georgianum Sluiter. 1 specimen.
Eugyra kerguelenensis Herdman. 77 specimens.
Alloeocarpa incrustans (Herdman). 2 specimens.

Station 1948. 4. i. 37. 60° 49′ 24″ S., 52° 40′ W. Russell rectangular dredge, 490–610 m.

Pyura discoveryi (Herdman). 1 specimen.

Station 1952. 11. i. 37. Between Penguin Island and Lion's Rump, King George Island, South Shetlands. Russell rectangular dredge, 367–383 m.

Aplidium caeruleum Sluiter. 2 specimens.
C. verrucosa (Lesson). 1 specimen.
Cnemidocarpa pfefferi (Michaelsen). 1 specimen.
Pyura bouvetensis (Michaelsen). 3 specimens.

Station 1955. 29. i. 37. 61° 35′ 6″ S., 57° 23′ 18″ W. Russell rectangular dredge, 440–410 m.

Pyura bouvetensis (Michaelsen). 1 specimen.

R.R.S. 'William Scoresby'

Station WS 25. 17. xii. 26. Undine Harbour (North), South Georgia. Small beam trawl, mud and sand, 18–27 m.

Aplidium falklandicum sp.n. 1 specimen.
Cnemidocarpa verrucosa (Lesson). 1 specimen.
Ascidia translucida Herdman. 2 specimens.
Polyzoa reticulata (Herdman). 1 specimen.

Station WS 27. 19. xii. 26. 53° 55′ S., 38° 01′ W. 1 m. tow-net, gravel, 104 and 107 m.

Aplidium falklandicum sp.n. 1 specimen.
Ascidia challengeri Herdman. 1 specimen.
Synoicum giardi (Herdman). 1 specimen.
Polyzoa reticulata (Herdman). 1 specimen.
Tylobranchion speciosum Herdman. 18 specimens.
Molgula pedunculata Herdman. 1 specimen.

Station WS 33. 21. xii. 26. 54° 59′ S., 35° 24′ W. 1 m. horizontal tow-net 0–5 m., 1 m. horizontal tow-net, grey mud and stones, 130 m.

Synoicum adareanum (Herdman). 1 specimen.
?*Sycozoa georgiana* (Michaelsen). 1 specimen.
Distaplia cylindrica (Lesson). 1 specimen.

Station WS 62. 19. i. 27. Wilson Harbour, South Georgia. Small beam trawl, 26–83 m.

Pyura georgiana Michaelsen. 3 specimens.

Station WS 65. 21. i. 27. Undine Harbour (North), South Georgia. Shore collection.

Alloeocarpa incrustans (Herdman). 1 specimen.

Station WS 71. 23. ii. 27. 6 miles N. 60° E. of Cape Pembroke Lt., East Falkland Island. Commercial otter trawl, 82–80 m.

Aplidium fuegiense Cunningham. 4 specimens.
Polyzoa opuntia Lesson. 6 specimens.
P. reticulata (Herdman). 1 specimen.
Alloeocarpa incrustans (Herdman). 7 specimens.
Cnemidocarpa nordenskjöldi (Michaelsen). 5 specimens.
C. verrucosa (Lesson). 10 specimens.
Pyura legumen (Lesson). 3 specimens.
Paramolgula gregaria (Lesson). 6 specimens.

Station WS 72. 5. iii. 27. 51° 07′ S., 57° 34′ W. Commercial otter trawl, 95 m.

Aplidium variabile (Herdman). 3 specimens.
A. falklandicum sp.n. 3 specimens.
Paramolgula gregaria (Lesson). 6 specimens.

Station WS 73. 6. iii. 27. From 51° 02′ S., 58° 55′ W. to 51° S., 58° 53′ W. Commercial otter trawl, 121–130 m.

Aplidium fuegiense Cunningham. 26 specimens.
A. falklandicum sp.n. 1 specimen.
Paramolgula gregaria (Lesson). 9 specimens.

Station WS 75. 10. iii. 27. From 51° S., 60° 30′ W. to 51° 02′ 42″ S., 60° 31′ 42″ W. Commercial otter trawl, 64–104 m.

Polyzoa opuntia Lesson. 1 specimen.

Station WS 76. 11. iii. 27. From 51° S., 62° W. to 51° S., 62° 04′ 36″ W. Commercial otter trawl, fine dark sand, 205–207 m.

Aplidium fuegiense Cunningham. 4 specimens.

Station WS 79. 13. iii. 27. From 51° S., 65° W. to 51° 03′ S., 64° 59′ W. Commercial otter trawl, fine dark sand, 132–131 m.

Aplidium fuegiense Cunningham. 2 specimens.
A. falklandicum sp.n. 4 specimens.
Paramolgula gregaria (Lesson). 5 specimens.

Station WS 80. 14. iii. 27. From 50° 58′ S., 63° 39′ W. to 50° 55′ 30″ S., 63° 36′ W. Commercial otter trawl, fine dark sand, 152–156 m.

Aplidium fuegiense Cunningham. 1 specimen.

Station WS 81. 19. iii. 27. 8 miles N. 11° W. of North Island, Falkland Islands. From 51° 03′ S., 61° 15′ W. to 51° 30′ 30″ S., 61° 10′ W. Commercial otter trawl, sand, 81–82 m.

Aplidium falklandicum sp.n. 4 specimens.
Cnemidocarpa verrucosa (Lesson). 11 specimens.

Station WS 82. 21. iii. 27. From 54° 05′ S., 57° 45′ W. to 54° 07′ S., 57° 47′ 30″ W. Commercial otter trawl, 140–144 m.

Polyzoa reticulata (Herdman). 1 specimen.

Station WS 83. 24. iii. 27. 14 miles S. 64° W. of George Island, East Falkland Island. From 52° 28′ S., 60° 06′ W. to 52° 30′ S., 60° 09′ 30″ W. Commercial otter trawl, fine green sand and shells, 137–129 m.

Aplidium fuegiense Cunningham. 4 specimens.

Station WS 84. 24. iii. 27. 7½ miles S. 9° W. of Sea Lion Island, East Falkland Island. From 52° 33′ S., 59° 08′ W. to 52° 34′ 30″ S., 59° 11′ W. Commercial otter trawl, coarse sand, shells and stones, 75–74 m.

Aplidium fuegiense Cunningham. 3 specimens.
A. falklandicum sp.n. 3 specimens.
Tridemnum auriculatum Michaelsen. 1 specimen.
Sycozoa sigillinoides Lesson. 1 specimen.
Alloeocarpa incrustans (Herdman). 1 specimen.
Pyura legumen (Lesson). 1 specimen.

Station WS 85. 25. iii. 27. 8 miles S. 66° E. of Lively Island, East Falkland Island. From 52° 09′ S., 58° 14′ W. to 52° 08′ S., 58° 09′ W. Commercial otter trawl, sand and shells, 79 m.

Aplidium fuegiense Cunningham. 2 specimens.
Sycozoa sigillinoides Lesson. 1 specimen.
Polyzoa reticulata (Herdman). 13 specimens.
Cnemidocarpa verrucosa (Lesson). 1 specimen.

Station WS 86. 3. iv. 27. From 53° 53′ S., 60° 37′ W. to 53° 54′ S., 60° 30′ W. Commercial otter trawl, sand, shells and stones, 151–147 m.

Aplidium fuegiense Cunningham. 3 specimens.
A. falklandicum sp.n. 1 specimen.
Polyzoa opuntia Lesson. 1 specimen.
Alloeocarpa incrustans (Herdman). 1 specimen.

Station WS 88. 6. iv. 27. From 54° 00′ S., 65° 00′ W. to 54° 00′ S., 64° 55′ W. Commercial otter trawl, 118 m.

Paramolgula gregaria (Lesson). 1 specimen.

Station WS 89. 7. iv. 27. 9 miles N. 21° E. of Arenas Pt. Lt., Tierra del Fuego. From 53° 01′ S., 68° 07′ W. to 52° 59′ 30″ S., 68° 06′ W. Commercial otter trawl, mud, gravel and stones, 23–21 m.

Pyura legumen (Lesson). 1 specimen.
Paramolgula gregaria (Lesson). 5 specimens.

Station WS 90. 7. iv. 27. 13 miles N. 83° E. of Cape Virgins Lt., Argentine Republic. From 52° 18′ S., 68° W. to 52° 19′ 30″ S., 67° 57′ W. Commercial otter trawl, fine dark sand, 82–81 m.

Aplidium fuegiense Cunningham. 4 specimens.
A. falklandicum sp.n. 3 specimens.
Sycozoa sigillinoides Lesson. 1 specimen.
Distaplia cylindrica (Lesson). 1 specimen.
Pyura legumen (Lesson). 1 specimen.

Station WS 91. 8. iv. 27. From 52° 54′ 30″ S., 64° 39′ W. to 52° 53′ S., 64° 36′ W. Commercial otter trawl, fine dark sand and shells, 191–205 m.

Aplidium fuegiense Cunningham. 2 specimens.
A. variabile (Herdman). 15 specimens.
A. falklandicum sp.n. 4 specimens.

Station WS 92. 8. iv. 27. From 52° S., 65° W. to 51° 57′ S., 65° 02′ W. Commercial otter trawl, fine dark sand and stones, 145–143 m.

Aplidium fuegiense Cunningham. 1 specimen.
Sycozoa sigillinoides Lesson. 11 specimens.

Station WS 93. 9. iv. 27. 7 miles S. 80° W. of Beaver Island, West Falkland Island. From 51° 51′ S., 61° 30′ W. to 51° 54′ S., 61° 30′ W. Commercial otter trawl, grey sand, 133–130 m.

Aplidium circumvolutum (Sluiter). 1 specimen.
A. fuegiense Cunningham. 3 specimens.
A. variabile (Herdman). 1 specimen.
A. falklandicum sp.n. 1 specimen.

Station WS 94. 16. iv. 27. From 50° S., 65° W. to 50° S., 64° 55′ 30″ W. Commercial otter trawl, fine dark sand, 110–126 m.

Aplidium fuegiense Cunningham. 2 specimens.
Cnemidocarpa nordenskjöldi (Michaelsen). 2 specimens.

Station WS 95. 17. iv. 27. From 48° 57′ S., 64° 45′ W. to 48° 59′ 30″ S., 64° 45′ W. Commercial otter trawl, fine dark sand, stones and shells, 109–108 m.

Aplidium fuegiense Cunningham. 2 specimens.
Polyzoa opuntia Lesson. 1 specimen.
Sycozoa sigillinoides Lesson. 1 specimen.

Station WS 99. 19. iv. 27. From 49° 41′ S., 59° 14′ W. to 49° 43′ S., 59° 15′ W. Commercial otter trawl, fine dark sand, 251–225 m.

Didemnum trivolutum sp.n. 3 specimens.

Station WS 108. 25. iv. 27. From 48° 30′ S., 63° 36′ W. to 48° 31′ 30″ S., 63° 31′ 30″ W. Commercial otter trawl, fine dark sand, 118–120 m.

Aplidium fuegiense Cunningham. 7 specimens.
A. falklandicum sp.n. 5 specimens.

Station WS 154. 26. ii. 28. 54° S., 36° 52′ W. Tow-net, 115–0 m.

Aplidium falklandicum sp.n. 1 specimen.

Station WS 182. 8. iii. 28. 55° 30′ S., 34° 50′ W. Tow-net, 750–520 m.

Aplidium falklandicum sp.n. 1 specimen.

Station WS 210. 29. v. 28. 50° 17′ S., 60° 06′ W. Commercial otter trawl, green sand, 161 m.

Paramolgula gregaria (Lesson). 2 specimens.

Station WS 214. 31. v. 28. 48° 25′ S., 60° 40′ W. Commercial otter trawl, fine dark sand, 208–219 m.

Sycozoa sigillinoides Lesson. 2 specimens.

Station WS 215. 31. v. 28. 47° 37′ S., 60° 50′ W. Commercial otter trawl, fine green sand, 219–146 m.

Sycozoa sigillinoides Lesson. 2 specimens.

Station WS 216. 1. vi. 28. 47° 37′ S., 60° 50′ W. Commercial otter trawl, fine sand, 219–133 m.

Alloeocarpa incrustans (Herdman). 1 specimen.

Station WS 219. 3. vi. 28. 47° 06′ S., 62° 12′ W. Commercial otter trawl, dark sand, 116–114 m.

Aplidium fuegiense Cunningham. 4 specimens.
A. falklandicum sp.n. 11 specimens.
A. variabile (Herdman). 5 specimens.

Station WS 220. 3. vi. 28. 47° 56′ S., 62° 38′ W. Commercial otter trawl, brown sand, 108–104 m.

Aplidium fuegiense Cunningham. 1 specimen.
A. falklandicum sp.n. 2 specimens.
A. variabile (Herdman). 1 specimen.
Sycozoa sigillinoides Lesson. 2 specimens.

Station WS 221. 4. vi. 28. 48° 23′ S., 65° 15′ W. Commercial otter trawl, brown sand, mud, pebbles, large stones and shells, 76–91 m.

Polyzoa opuntia Lesson. 2 specimens.
Cnemidocarpa nordenskjöldi (Michaelsen). 1 specimen.

Station WS 222. 8. vi. 28. 48° 23′ S., 65° W. Commercial otter trawl, coarse brown sand and shells, 100–106 m.

Aplidium falklandicum sp.n. 6 specimens.
Paramolgula gregaria (Lesson). 1 specimen.

Station WS 226. 10. vi. 28. 49° 20′ S., 62° 30′ W. Commercial otter trawl, green sand, 144–152 m.

Sycozoa sigillinoides Lesson. 14 specimens.

Station WS 229. 1. vii. 28. 50° 35′ S., 57° 20′ W. Commercial otter trawl, fine green sand, 210–271 m.

Aplidium stanleyi sp.n. 11 specimens.

Station WS 233. 5. vii. 28. 49° 25′ S., 59° 45′ W. Commercial otter trawl, fine green sand, 185–175 m.

Aplidium fuegiense Cunningham. 1 specimen.

Station WS 235. 6. vii. 28. 47° 56′ S., 61° 10′ W. Commercial otter trawl, dark green sand, 155 m.

Aplidium variabile (Herdman). 1 specimen.

Station WS 237. 7. vii. 28. 46° S., 60° 05′ W. Commercial otter trawl, coarse brown sand and shells, 150–256 m.

Aplidium variabile (Herdman). 1 specimen.
Sycozoa sigillinoides Lesson. 1 specimen.

Station WS 239. 15. vii. 28. 51° 10′ S., 62° 10′ W. Commercial otter trawl, coarse dark sand, 196–193 m.

Aplidium falklandicum sp.n. 2 specimens.
Sycozoa sigillinoides Lesson. 1 specimen.

Station WS 243. 17. vii. 28. 51° 06′ S., 64° 30′ W. Commercial otter trawl, coarse dark sand, 144–141 m.

Aplidium falklandicum sp.n. 5 specimens.
Cnemidocarpa nordenskjöldi (Michaelsen). 7 specimens.
Sycozoa sigillinoides Lesson. 2 specimens.
Paramolgula gregaria (Lesson). 4 specimens.
Tylobranchion speciosum Herdman. 1 specimen.

Station WS 244. 18. vii. 28. 52° S., 62° 40′ W. Commercial otter trawl, fine dark sand and mud, 253–247 m.

Aplidium circumvolutum (Sluiter). 13 specimens.
Sycozoa sigillinoides Lesson. 8 specimens.
A. falklandicum sp.n. 6 specimens.

Station WS 245. 18. vii. 28. 52° 36′ S., 63° 40′ W. Commercial otter trawl, dark green sand, 304–290 m.

Sycozoa sigillinoides Lesson. 28 specimens.

Station WS 246. 19. vii. 28. 52° 25′ S., 61° W. Commercial otter trawl, coarse green sand and pebbles, 267–208 m.

Didemnum studeri Hartmeyer. 2 specimens.

Station WS 247. 19. vii. 28. 52° 40′ S., 60° 05′ W. Large heavy dredge, rocks, 172 m.

Aplidium fuegiense Cunningham. 1 specimen.
Cnemidocarpa nordenskjöldi (Michaelsen). 11 specimens.
Alloeocarpa incrustans (Herdman). 1 specimen.

Station WS 249. 20. vii. 28. 52° 10′ S., 57° 30′ W. Large heavy dredge, fine brown and green sand, shells and stones, 166 m.

Aplidium fuegiense Cunningham. 1 specimen.

Station WS 567. 6. iii. 31. 53° 54′ 15″ S., 37° 05′ 30″ W. 70 cm. tow-net, 145 m.

Pyura georgiana Michaelsen. 1 specimen.

Station WS 582. 30. iv. 31. 53° 42′ 30″ S., 70° 55′ W. Hand lines, 12 m.

Cnemidocarpa nordenskjöldi (Michaelsen). 1 specimen.

Station WS 583. 2. v. 31. 53° 39′ S., 70° 54′ 30″ W., Magellan Strait. Small beam trawl, 14–78 m.

Aplidium fuegiense Cunningham. 2 specimens.
Cnemidocarpa nordenskjöldi (Michaelsen). 2 specimens.

Station WS 742. 5. ix. 31. 38° 22′ S., 73° 41′ W. Small beam trawl, 47–35 m.

Molgula platei Hartmeyer. 27 specimens.

Station WS 756. 10. x. 31. From 50° 53′ S., 60° W. to 50° 56′ 18″ S., 59° 56′ W., to 50° 59′ 30″ S., 59° 52′ W. Commercial otter trawl, black gravel, green mud and sand, 104–119 m.

Paramolgula gregaria (Lesson). 1 specimen.

Station WS 764. 17. x. 31. From 44° 40′ S., 62° W. to 44° 36′ 30″ S., 61° 57′ W., to 44° 41′ S., 61° 52′ W. Commercial otter trawl, fine green sand, 110–104 m.

Aplidium fuegiense Cunningham. 6 specimens.
A. falklandicum sp.n. 7 specimens.

Station WS 765. 17. x. 31. From 45° 06′ S., 60° 30′ W., to 45° 08′ S., 60° 26′ 30″ W. Commercial otter trawl, brown and green mud and sand, 113–119 m.

Aplidium falklandicum sp.n. 2 specimens.
Distaplia cylindrica (Lesson). 1 specimen.
Sycozoa sigillinoides Lesson. 24 specimens.
Alloeocarpa incrustans (Herdman). 2 specimens.

Station WS 771. 29. x. 31. From 42° 40′ S., 60° 32′ W. to 42° 43′ 30″ S., 60° 30′ W. Commercial otter trawl, dark green sand, 90 m.

Aplidium fuegiense Cunningham. 1 specimen.
A. falklandicum sp.n. 1 specimen.
A. variabile (Herdman). 1 specimen.

Station WS 772. 30. x. 31. From 45° 13′ S., 60° W. to 45° 13′ 48″ S., 60° 00′ 30″ W. Commercial otter trawl, grey sand, 309–163 m.

Aplidium variabile (Herdman). 2 specimens.
Sycozoa sigillinoides Lesson. 9 specimens.

Station WS 774. 1. xi. 31. From 47° 09′ S., 62° W. to 47° 07′ S., 62° 04′ W. Commercial otter trawl, dark green sand and mud, 139–144 m.

Aplidium falklandicum sp.n. 2 specimens.

Station WS 775. 2. xi. 31. From 46° 44′ 30″ S., 63° 30′ W. to 46° 45′ S., 63° 36′ W. Commercial otter trawl, gravel and fine grey sand, 115–110 m.

Aplidium circumvolutum (Sluiter). 3 specimens.
Sycozoa sigillinoides Lesson. 3 specimens.
A. fuegiense Cunningham. 1 specimen.
Agnesia glaciata Michaelsen. 3 specimens.
A. falklandicum sp.n. 1 specimen.

Station WS 776. 3. xi. 31. From 46° 19′ S., 65° W. to 46° 17′ 30″ S., 65° 04′ 30″ W. Commercial otter trawl, grey mud and sand, 110–99 m.

Aplidium fuegiense Cunningham. 1 specimen.
Paramolgula gregaria (Lesson). 1 specimen.
Styela magalhaensis Michaelsen. 1 specimen.

Station WS 781. 6. xi. 31. From 50° 29′ S., 58° 52′ W. to 50° 31′ S., 58° 48′ W. Commercial otter trawl, dark green sand and mud, 148 m.

Aplidium fuegiense Cunningham. 7 specimens.
Paramolgula gregaria (Lesson). 2 specimens.
A. variabile (Herdman). 6 specimens.

Station WS 782. 4. xii. 31. From 50° 30′ S., 58° 19′ W. to 50° 28′ 30″ S., 58° 23′ 30″ W. to 50° 27′ S., 58° 31′ W. Commercial otter trawl, green sand and rocks, 141–146 m.

Aplidium circumvolutum (Sluiter). 1 specimen.
A. falklandicum sp.n. 1 specimen.
A. variabile (Herdman). 6 specimens.
Paramolgula gregaria (Lesson). 3 specimens.

Station WS 783. 5. xii. 31. From 50° 03′ 30″ S., 60° 08′ W. to 50° 02′ S., 60° 12′ W. to 50° 03′ 30″ S., 60° 16′ W. Commercial otter trawl, 165–0 m. Conical dredge, 157 m.

Aplidium circumvolutum (Sluiter). 26 specimens.
A. variabile (Herdman). 2 specimens.

Station WS 784. 5. xii. 31. From 49° 48′ 30″ S., 61° 03′ W. to 49° 47′ S., 61° 07′ W. Commercial otter trawl, dark green sand and rocks, 170–164 m.

Aplidium circumvolutum (Sluiter). 1 specimen.
Cnemidocarpa nordenskjöldi (Michaelsen). 5 specimens.
Sycozoa sigillinoides Lesson. 1 specimen.
Paramolgula gregaria (Lesson). 2 specimens.

Station WS 785. 6. xii. 31. From 49° 27′ S., 62° 32′ W. to 49° 26′ S., 62° 36′ W. to 49° 24′ 30″ S., 62° 39′ W. to 49° 23′ S., 62° 43′ 30″ W. Commercial otter trawl, dark green sand, 150–147 m.

Sycozoa sigillinoides Lesson. 7 specimens.

Station WS 787. 7. xii. 31. From 48° 44′ S., 65° 24′ 30″ W. to 48° 48′ S., 65° 25′ W. Commercial otter trawl, coarse brown speckled sand, 106–110 m.

Aplidium fuegiense Cunningham. 15 specimens.
A. falklandicum sp.n. 5 specimens.
A. variabile (Herdman). 1 specimen.
Distaplia cylindrica (Lesson). 3 specimens.

Station WS 788. 13. xii. 31. From 45° 06′ 30″ S., 64° 56′ W. to 45° 07′ 30″ S., 64° 52′ W. Commercial otter trawl, speckled grey mud, sand and gravel, 82–88 m.

Polyzoa opuntia Lesson. 1 specimen.
Pyura legumen (Lesson). 1 specimen.

Station WS 791. 14. xii. 31. From 45° 38′ S., 62° 57′ W. to 45° 39′ 30″ S., 62° 53′ W. to 45° 44′ S., 62° 37′ W. Commercial otter trawl, green sand, 97–95 m., 95–101 m.

Aplidium fuegiense Cunningham. 15 specimens.
A. falklandicum sp.n. 12 specimens.
A. variabile (Herdman). 3 specimens.
Paramolgula gregaria (Lesson). 1 specimen.

Station WS 792. 15. xii. 31. From 45° 49′ S., 62° 23′ W. to 45° 50′ S., 62° 18′ 30″ W. to 45° 54′ 30″ S., 62° 04′ W. Commercial otter trawl, dark green sand and rocks, 102–106 m.

Aplidium fuegiense Cunningham. 7 specimens.
A. falklandicum sp.n. 8 specimens.

Station WS 793. 15. xii. 31. From 45° 52′ 18″ S., 61° 37′ W. to 45° 53′ 48″ S., 61° 33′ W. Commercial otter trawl, rocks, 108–111 m.

Aplidium variabile (Herdman). 8 specimens.
A. falklandicum sp.n. 4 specimens.

Station WS 794. 17. xii. 31. From 46° 11′ 48″ S., 61° 01′ W. to 46° 13′ 30″ S., 60° 57′ 30″ W. Commercial otter trawl, 123–126 m.

Aplidium variabile (Herdman). 1 specimen.
Synoicum georgianum Sluiter. 2 specimens.

Station WS 796. 21. xii. 31. From 47° 51′ S., 63° 43′ W. to 47° 56′ S., 63° 22′ W. Commercial otter trawl, 106–113 and 108–112 m.

Aplidium variabile (Herdman). 2 specimens.
Paramolgula gregaria (Lesson). 8 specimens.
A. falklandicum sp.n. 1 specimen.

Station WS 797. 20. xii. 31. From 47° 44′ S., 64° 22′ W. to 47° 45′ 12″ S., 64° 18′ W. to 47° 50′ 18″ S., 63° 57′ W. Commercial otter trawl, 115–111 m.

Aplidium fuegiense Cunningham. 9 specimens.
Paramolgula gregaria (Lesson). 3 specimens.
A. variabile (Herdman). 6 specimens.

Station WS 798. 20. xii. 31. From 47° 31′ 30″ S., 62° 05′ W. to 47° 32′ 30″ S., 64° 58′ W. Commercial otter trawl, pebbles, shells and sand, 49–66 m.

Polyzoa opuntia Lesson. 7 specimens.
Paramolgula gregaria (Lesson). 3 specimens.

Station WS 799. 21. xii. 31. From 48° 03′ 30″ S., 62° 50′ 18″ W. to 48° 05′ S., 62° 46′ W. to 48° 10′ S., 62° 31′ W. (*a*) Hand net, 0 m.; (*b*) commercial otter trawl, dark green sand, 141–137 m.

Aplidium variabile (Herdman). 1 specimen.
Sycozoa sigillinoides Lesson. 6 specimens.

Station WS 800. 21–22. xii. 31. From 48° 15′ S., 62° 11′ 48″ W. to 48° 16′ 30″ S., 62° 08′ W. to 48° 21′ 30″ S., 61° 48′ W. Commercial otter trawl, dark sand and shells, 137–139 m.

Aplidium fuegiense Cunningham. 3 specimens.
Sycozoa sigillinoides Lesson. 2 specimens.

Station WS 801. 22. xii. 31. From 48° 25′ 30″ S., 61° 30′ W. to 48° 27′ S., 61° 26′ W. Commercial otter trawl, dark sand, 165 m.

Aplidium fuegiense Cunningham. 1 specimen.

Station WS 805. 6. i. 32. From 50° 11′ S., 63° 37′ W. to 50° 09′ 30″ S., 63° 31′ W. Commercial otter trawl, coarse dark speckled sand, 148–150 m.

Cnemidocarpa nordenskjöldi (Michaelsen). 11 specimens.

Station WS 807. 7. i. 32. From 49° 51′ S., 65° 01′ W. to 49° 50′ S., 65° 05′ W. Commercial otter trawl, dark sand, 124–126 m.

Aplidium fuegiense Cunningham. 2 specimens.
A. falklandicum sp.n. 1 specimen.

Station WS 808. 8. i. 32. From 49° 41′ S., 65° 40′ W. to 49° 39′ 30″ S., 65° 44′ W. Commercial otter trawl, brown and green sand, 110–106 m.

Aplidium fuegiense Cunningham. 6 specimens.
Paramolgula gregaria (Lesson). 1 specimen.
A. variabile (Herdman). 3 specimens.

Station WS 809. 8. i. 32. From 49° 29′ S., 62° 27′ W. to 49° 27′ 30″ S., 66° 31′ W. to 49° 32′ 30″S., 66° 51′ 30″ W. Commercial otter trawl, brown speckled sand, 104–101 m.

Aplidium fuegiense Cunningham. 1 specimen.

Station WS 811. 10. i. 32. From 51° 22′ S., 68° 03′ W. to 51° 27′ 30″ S., 67° 43′ W. Commercial otter trawl, 99 m.

Aplidium fuegiense Cunningham. 1 specimen.
Didemnum trivolutum sp.n. 1 specimen.
A. variabile (Herdman). 2 specimens.
Pyura legumen (Lesson). 2 specimens.

Station WS 813. 13. i. 32. From 51° 34′ 30″ S., 67° 18′ 30″ W. to 51° 36′ S., 67° 14′ W. Commercial otter trawl, dark speckled sand, 106–102 m.

Aplidium fuegiense Cunningham. 1 specimen.
A. falklandicum sp.n. 2 specimens.
A. variabile (Herdman). 107 specimens.

Station WS 814. 13. i. 32. From 51° 44′ 30″ S., 66° 38′ W. to 51° 46′ S., 66° 42′ W. Commercial otter trawl, speckled sand, 112–119 m.

Sycozoa sigillinoides Lesson. 2 specimens.

Station WS 816. 14. i. 32. From 52° 09′ 30″ S., 64° 58′ W. to 52°10′ S., 64° 54′ W. Commercial otter trawl, shingle, 150 m.

Aplidium variabile (Herdman). 3 specimens.
Sycozoa sigillinoides Lesson. 2 specimens.

Station WS 818. 17. i. 32. From 52° 30′ 30″ S., 63° 27′ W. to 52° 32′ S., 63° 23′ W. to 52° 37′ S., 63° 02′ W. Commercial otter trawl, dark speckled sand, 272–278 m.

Sycozoa sigillinoides Lesson. 5 specimens.

Station WS 819. 17. i. 32. From 52° 41′ 18″ S., 62° 41′ W. to 52° 42′ 30″ S., 62° 38′ W. to 52° 47′ 30″ S., 62° 17′ W. Commercial otter trawl, dark speckled sand, 313–329 m.

Sycozoa sigillinoides Lesson. 1 specimen.

Station WS 823. 19. i. 32. From 52° 12′ 30″ S., 60° 02′ W. to 52° 16′ 30″ S., 60° W. Commercial otter trawl, green grey fine sand, 80–95 m.

Polyzoa reticulata (Herdman). 1 specimen.
Cnemidocarpa verrucosa (Lesson). 1 specimen.
Paramolgula gregaria (Lesson). 1 specimen.

Station WS 824. 19. i. 32. From 52° 31′ S., 58° 29′ W. to 52° 27′ 30″ S., 58° 28′ 30″ W. Commercial otter trawl, green speckled sand and shells, 146–137 m.

Aplidium circumvolutum (Sluiter). 11 specimens.
A. variabile (Herdman). 5 specimens.

Station WS 833. 1. ii. 32. From 52° 28′ S., 68° W. to 52° 32′ S., 68° W. Commercial otter trawl, brown and grey mud and fine sand, 38–31 m.

Sycozoa sigillinoides Lesson. 3 specimens.

Station WS 834. 2. ii. 32. From 52° 57′ S., 68° 07′ W. to 52° 58′ 30″ S., 68° 09′ 30″ W. Commercial otter trawl, dark brown grey shingle and stones, 27–38 m.

Sycozoa sigillinoides Lesson. 50 specimens.
Polyzoa opuntia Lesson. 2 specimens.
Pyura legumen (Lesson). 1 specimen.
Paramolgula gregaria (Lesson). 8 specimens.

Station WS 837. 3. ii. 32. From 52° 48′ 30″ S., 66° 30′ W. to 52° 50′ S., 66° 26′ W. Commercial otter trawl, coarse dark green sand and pebbles, 102 m.

Aplidium fuegiense Cunningham. 10 specimens.
Polyzoa opuntia Lesson. 2 specimens.

Station WS 838. 5. ii. 32. From 53° 11′ S., 65° 02′ W. to 53° 12′ 30″ S., 64° 58′ W. Commercial otter trawl, 149–159 m.

Aplidium variabile (Herdman). 2 specimens.

Station WS 839. 5. ii. 32. From 53° 29′ 30″ S., 63° 31′ W. to 53° 31′ S., 63° 27′ W. Commercial otter trawl, 503–534 m.

Sycozoa sigillinoides Lesson. 1 specimen.

Station WS 841. 6. ii. 32. From 54° 11′ S., 60° 23′ W. to 54° 12′ 30″ S., 60° 20′ W. Commercial otter trawl, shingle and shells, 110–121 m.

Aplidium fuegiense Cunningham. 1 specimen.
Sycozoa sigillinoides Lesson. 3 specimens.
Tylobranchion speciosum Herdman. 1 specimen.
Styela paessleri Michaelsen. 1 specimen.

Station WS 847. 9. ii. 32. From 50° 15′ S., 67° 59′ W. to 50° 16′ 30″ S., 67° 55′ W. to 50° 21′ S., 67° 33′ W. Commercial otter trawl, 57–84 m. and 51–57 m.

Aplidium fuegiense Cunningham. 6 specimens.
A. variabile (Herdman). 3 specimens.
A. falklandicum sp.n. 2 specimens.
Sycozoa sigillinoides Lesson. 5 specimens.
Cnemidocarpa nordenskjöldi (Michaelsen). 1 specimen.
Paramolgula gregaria (Lesson). 4 specimens.

Station WS 849. 10. ii. 32. From 50° 56′ 30″ S., 65° W. to 50° 57′ S., 66° 22′ W. Commercial otter trawl, dark sand, 137 m.

Paramolgula gregaria (Lesson). 1 specimen.

Station WS 852. 21. iii. 32. 44° 12′ 30″ S., 64° 13′ W. Small beam trawl, 86–88 m.

Pyura legumen (Lesson). 1 specimen.

Station WS 854. 22. iii. 32. 45° 16′ S., 64° 25′ W. Small beam trawl, 97 m.

Eugyra kerguelenensis Herdman. 8 specimens.

Station WS 856. 23. iii. 32. 46° 35′ S., 64° 11′ W. Small beam trawl, 104 m.

Aplidium circumvolutum (Sluiter). 30 specimens.
Eugyra kerguelenensis Herdman. 1 specimen.

Station WS 857. 23. iii. 32. From 47° 11′ S., 64° 15′ W. to 47° 12′ S., 64° 09′ W. Commercial otter trawl, 123–124 m.

Aplidium variabile (Herdman). 2 specimens.

Station WS 858. 24. iii. 32. From 45° 42′ S., 60° 30′ W. to 45° 40′ 30″ S., 60° 33′ W. Commercial otter trawl, 132–123 m.

Aplidium falklandicum sp.n. 1 specimen.

Station WS 861. 27. iii. 32. 47° 40′ S., 64° 12′ W. Small beam trawl, 117–124 m.

Paramolgula gregaria (Lesson). 4 specimens.

Station WS 863. 28. iii. 32. 49° 05′ S., 64° 09′ W. Small beam trawl, 121–117 m.

Paramolgula gregaria (Lesson). 2 specimens.

Station WS 864. 28. iii. 32. From 49° 32′ S., 64° 15′ W. to 49° 35′ S., 64° 17′ W. Commercial otter trawl, 128–126 m.

Paramolgula gregaria (Lesson). 4 specimens.

Station WS 865. 29. iii. 32. 50° 03′ S., 64° 14′ W. Small beam trawl, 126–128 m.

Aplidium variabile (Herdman). 3 specimens. *A. falklandicum* sp.n. 2 specimens.

Station WS 869. 31. iii. 32. 52° 15′ 30″ S., 64° 13′ 48″ W. Small beam trawl, 187–201 m.

Aplidium variabile (Herdman). 10 specimens.

Station WS 871. 1. iv. 32. 53° 16′ S., 64° 12′ W. Small beam trawl, 336–342 m.

Aplidium fuegiense Cunningham. 2 specimens. *Cystodytes dellechiajei* Della Valle. 11 specimens.

Marine Biological Station

Station MS 6. 12. ii. 25. East Cumberland Bay, South Georgia. $\frac{1}{4}$ mile south of Hope Pt. to $1\frac{1}{4}$ cables south by east of King Edward Pt. Lt. Small beam trawl, 24–30 m.

Alloeocarpa incrustans (Herdman). 1 specimen.

Station MS 10. 14. ii. 25. East Cumberland Bay, South Georgia. $\frac{1}{4}$ mile S.E. of Hope Pt. to $\frac{1}{4}$ mile S. of Government Flagstaff. Small beam trawl, 26–18 m.

Synoicum georgianum Sluiter. 2 specimens. *Polyzoa reticulata* (Herdman). 1 specimen.
Ascidia translucida Herdman. 2 specimens. *Alloeocarpa incrustans* (Herdman). 1 specimen.

Station MS 14. 17. ii. 25. From 1·5 miles S.E. by S. to 1·5 miles S. $\frac{1}{2}$ W. of Sappho Pt., East Cumberland Bay, South Georgia. Small dredge, 190–110 m.

Sycozoa georgiana (Michaelsen). 4 specimens. *Pyura georgiana* Michaelsen. 4 specimens.
Polyzoa reticulata (Herdman). 1 specimen.

Station MS 33. 1. v. 25. 1 cable E. of Hobart Rock, East Cumberland Bay, South Georgia. Small beam trawl, 40 m.

Polyzoa opuntia Lesson. 1 specimen. *Alloeocarpa incrustans* (Herdman). 1 specimen.

Station MS 62. 24. ii. 26. East Cumberland Bay, South Georgia. $\frac{1}{2}$ cable E. to $3\frac{3}{4}$ cables S. of Hobart Pt. Small beam trawl, 31 m.

Polyzoa reticulata (Herdman). 1 specimen.

Station MS 63. 24. ii. 26. East Cumberland Bay, South Georgia. 1·3 miles S. by E. to 1·6 miles S.E. by S. of Hope Pt. Small beam trawl, 23 m.

Distaplia colligans Sluiter. 2 specimens.

Station MS 64. 24. ii. 26. East Cumberland Bay, South Georgia. 1·8 miles S.E. by S. of King Edward Pt. Lt. Small dredge, 7–15 m.

Aplidium variabile (Herdman). 3 specimens.
Synoicum giardi (Herdman). 1 specimen.
Polyzoa opuntia. Lesson 1 specimen.
Alloeocarpa incrustans (Herdman). 2 specimens.

Station MS 65. 28. ii. 26. East Cumberland Bay, South Georgia. 1·6 miles S.E. of Hobart Rock to 1 cable N. of Dartmouth Pt. Small beam trawl, 39 m.

Aplidium circumvolutum (Sluiter). 1 specimen.
Ascidia translucida Herdman. 1 specimen.

Station MS 67. 28. ii. 26. East Cumberland Bay, South Georgia. 3 cables N.E. of Hobart Rock to ½ cable W. of Hope Pt. Small beam trawl, 38 m.

Alloeocarpa incrustans (Herdman). 1 specimen.

Station MS 68. 2. iii. 26. East Cumberland Bay, South Georgia. 1·7 miles S. ½ E. to 8½ cables S.E. by E. of Sappho Pt. Large rectangular net, 220–247 m.

Sycozoa georgiana (Michaelsen). 4 specimens.
Distaplia cylindrica (Lesson). 7 specimens.
Ascidia translucida Herdman. 2 specimens.
Cnemidocarpa verrucosa (Lesson). 2 specimens.
Pyura georgiana Michaelsen. 6 specimens.
Molgula pedunculata Herdman. 1 specimen.
Ascopera gigantea Herdman. 39 specimens.

Station MS 71. 9. iii. 26. East Cumberland Bay, South Georgia. 9¼ cables E. by S. to 1·2 miles E. by S. of Sappho Pt. Small beam trawl, 110–60 m.

?*Aplidium fuegiense* Cunningham. 3 specimens.
?*A. variabile* (Herdman). 22 specimens.
Synoicum adareanum (Herdman). 1 specimen.
S. giardi (Herdman). 1 specimen.
Didemnum studeri Hartmeyer. 1 specimen.
Ascidia challengeri Herdman. 1 specimen.
Polyzoa reticulata (Herdman). 1 specimen.
Cnemidocarpa verrucosa (Lesson). 3 specimens.
Paramolgula gregaria (Lesson). 3 specimens.

Station MS 74. 17. iii. 26. East Cumberland Bay, South Georgia. 1 cable S.E. by E. of Hope Pt. to 3·1 miles S.W. of Merton Rock. Small beam trawl, 22–40 m.

Synoicum georgianum Sluiter. 1 specimen.
Distaplia colligans Sluiter. 2 specimens.
Polyzoa reticulata (Herdman). 1 specimen.
Alloeocarpa incrustans (Herdman). 8 specimens.

British Graham Land Expedition, 1934–7

Stella Creek (6. v. 35)
Ascidia challengeri Herdman. 3 specimens.
Cnemidocarpa verrucosa (Lesson). 14 specimens.

Stella Creek. (5. x. 35)
Distaplia cylindrica (Lesson). 1 specimen.

Port Lockroy. (23. i. 35)
Distaplia cylindrica (Lesson). 1 specimen.

Deception Island, South Shetlands

3. i. 24. 25–30 m.
Ascopera gigantea Herdman. 6 specimens.

Port Stanley, Falkland Islands

9. iii. 26. Shore collection
Polyzoa opuntia Lesson. 1 specimen.

17. vi. 28. Shore collection
Polyzoa opuntia Lesson. 1 specimen.

ABBREVIATIONS USED IN TEXT-FIGURES

a.	anus	*oe.*	oesophagus
a.l.	atrial languet	*od.*	oviduct
amp.	ampulla	*o.o.*	oral opening
a.o.	atrial opening	*o.s.*	oral siphon
a.p.	ampulla of pyloric gland	*ov.*	ovary
a.s.	atrial siphon	*p.*	papilla
a.sw.	ampullary swelling	*p.a.*	post-abdomen
b.c.	blood channels	*p.b.*	parastigmatic bar
b.f.	branchial fold	*p.bd.*	peripharyngeal band
b.p.	branchial papilla	*pc.*	pericardium
br.p.	brood pouch	*py.c.*	pyloric caecum
c.cl.c.	common cloacal chamber	*p.st.*	post-stomach
d.f.	dorsal fold	*r.*	rectum
d.l.	dorsal languet	*rb.*	rib of oral tentacle
d.la.	dorsal lamina	*res.*	reserve material
d.p.	dorsal papilla	*r.s.*	renal sac
d.t.	dorsal tubercle	*r.v.*	radial vessels
e.	endostyle	*s.d.*	sperm duct
emb.	embryo	*s.d.c.*	sperm duct convolutions
en.	endocarp	*sk.*	stalk
ep.c.	epicardiac cavity	*sn.*	stolon
ep.s.	suture of epicardium and body wall	*st.*	stomach
fl.	flange	*st.c.*	stomach caecum
g.	gonad	*t.*	testis
ga.	ganglion	*th.*	thorax
h.	heart	*t.m.*	transverse muscles
i.	intestine	*tn.*	tentacle
inf.	infundibulum	*t.p.*	transverse-bar papilla
l.a.	lateral ampulla	*tri.*	thoracic triangle
l.b.	longitudinal bar	*t.t.*	test teeth
lg.	ligament	*t.z.*	terminal zooid
l.m.	longitudinal muscles	*v.*	vesicle
l.t.o.	lateral thoracic organ	*v.c.*	vacuolated cell
m.a	median ampulla	*v.p.*	ventral papilla
m.i.	mid-intestine	*v.pr.*	vascular process
mus.	muscle	*v.pr.o.*	origin of vascular process

DESCRIPTION OF SPECIES

Order *ENTEROGONA* Perrier, 1898

Suborder APLOUSOBRANCHIATA Lahille, 1886

Family POLYCLINIDAE Verrill, 1871

Subfamily POLYCLININAE Adams, 1858

Genus Aplidium Savigny, 1816

The genera *Aplidium* Savigny, 1816, and *Amaroucium* Milne Edwards, 1842, are not readily distinguishable and recently there has been a tendency to regard them as synonymous.

A varying number of diagnostic characters (Table 1) has been used by different authorities to separate the two genera.

Van Name (1945), using six diagnostic characters, noted that, even on this basis, 'there are intermediate forms that may be assigned to either genus'. (p. 28). He stated that *Amaroucium* 'hardly

merits recognition as anything more than a rather indefinitely distinguished subgenus or section of *Aplidium* Savigny', although it is 'universally adopted in all books on ascidians' (p. 30).

Berrill (1950) pointed out the difficulties involved in using van Name's list of diagnostic characters, and concluded that 'the situation is clearly absurd'. He adopted *Aplidium* as the comprehensive genus, with *Amaroucium* as a subgenus.

Using van Name's list of characters, I have compared forty species variously assigned to *Aplidium* and *Amaroucium*, taking details from published accounts. An additional character included in the comparison was the position of the anus relative to the rows of stigmata (Tokioka, 1953). With regard to this last character I find that, although in some species the anus is situated opposite the 4th row of stigmata, and in others opposite the 7th to 10th, yet the ratio of rows of stigmata anterior to anus to rows of stigmata posterior to anus gives no clear separation of species into two groups. The two characters which might be used to separate *Aplidium* and *Amaroucium* are (1) the arrangement of the

Table 1

	Aplidium	*Amaroucium*
Hartmeyer (1923–4)	Atrial siphon with or without languet Testis follicles in a bunch	Atrial siphon always with languet Testis follicles more or less regularly arranged along sperm duct
Harant & Vernières (1933)	Atrial languet absent	Atrial languet present
Huus (1937)	Atrial opening with or without languet Stomach longitudinally folded Post-abdomen relatively short Testes in a bunch or cluster	Atrial opening with long languet Stomach longitudinally folded Post-abdomen long Testis follicles biserially arranged along sperm duct
van Name (1945)	Colony sessile by a broad base Zooids rather stout, with few rows of stigmata Short post-abdomen Stomach with a few deep longitudinal folds Atrial opening well back on dorsal side Testes in a compact mass	Colony massive or capitate Zooids large with many rows of stigmata Long post-abdomen Stomach with distinct longitudinal plications Atrial opening well forward Testes serially arranged along the sperm duct

testes, and (2) the length of the post-abdomen. The first of these characters is undoubtedly influenced by the second, a short post-abdomen tending to produce a bunching of the testis follicles, but the length of the post-abdomen is itself an unsatisfactory character for generic distinction, as it varies greatly during the annual cycle of the zooids.

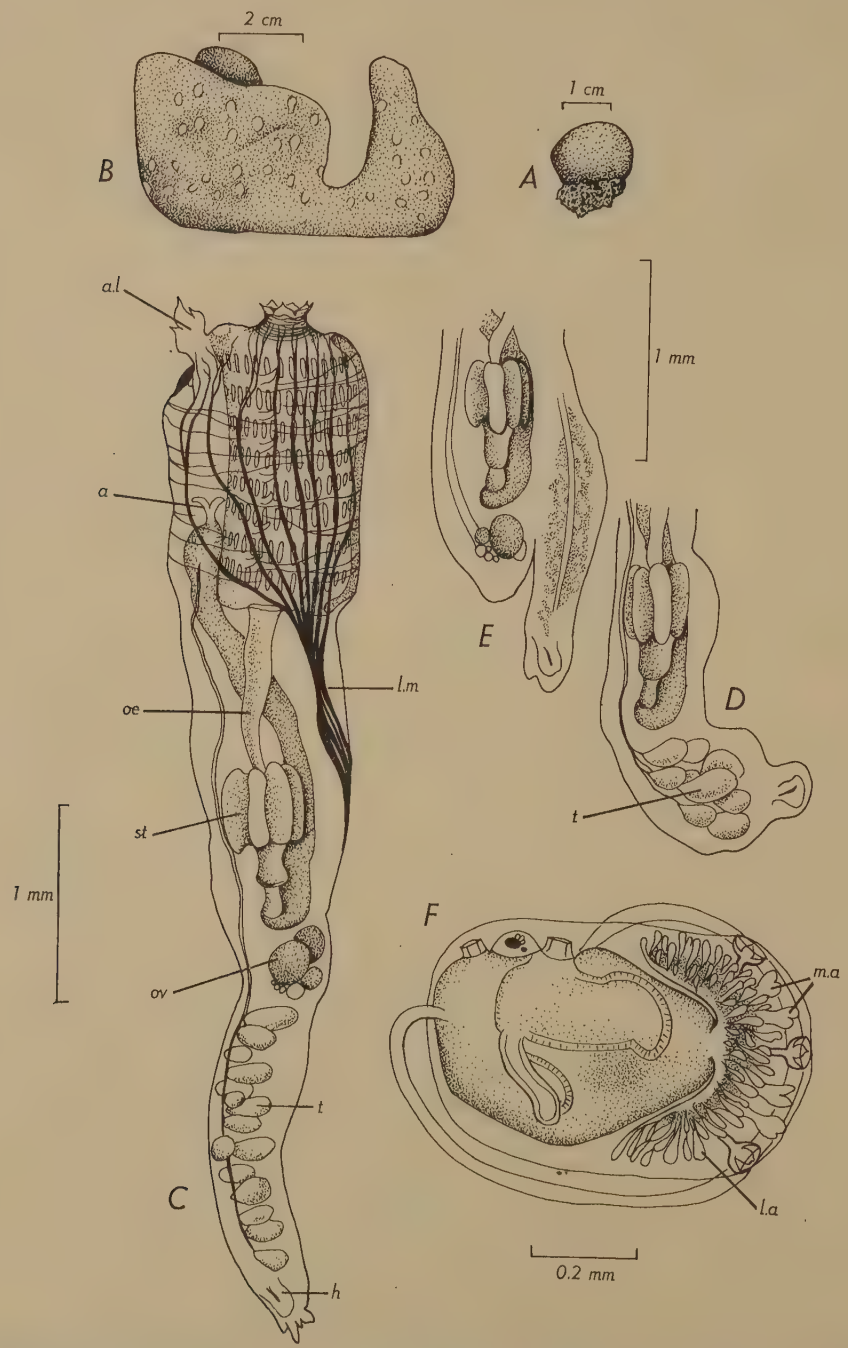
Another result of the shortening of the post-abdomen has been the development in *Aplidium pallidum* (Verrill) of a type of budding shown by Brien (1925) to involve division of the stomach. Should this feature be found to occur in other species, it might serve as a diagnostic character of *Aplidium*, but as so far it has been studied only in *A. pallidum*, such a course is not at present practicable.

The above considerations lead me to believe that there is no generic distinction to be made within the group, and I therefore agree with Berrill (1950) and Kott (1954) in adopting for all species the generic name *Aplidium*, which has priority over *Amaroucium*.

Aplidium circumvolutum (Sluiter) (Text-fig. 1; Pl. I, fig. 1)

Psammaplidium circumvolutum Sluiter, 1900, p. 14, pl. 1, fig. 7; pl. 3, fig. 1.
Amaroucium circumvolutum Michaelsen, 1924, p. 383.
Amaroucium circumvolutum var. *kerguelenense* Pérès, 1952, pp. 213–15, figs. 1, 2.

Occurrence. St. 39: S. Georgia, 179–235 m. St. 170: S. Shetlands, 342 m. St. 175: S. Shetlands, 200 m. St. 190: Palmer Archipelago, 93–126 m. St. WS 93: Falkland Islands, 133–130 m. St. WS 244: Patagonian Shelf, 253–247 m. St. WS 775: Patagonian Shelf, 115–110 m. St. WS 782: Patagonian Shelf, 141–146 m. St. WS 783: Patagonian Shelf, 157 m. St. WS 784: Falkland Islands,



Text-fig. 1. *Aplidium circumvolutum* (Sluiter): A, colony from Patagonian Shelf (St. WS 783); B, colony from S. Georgia (St. 39); C, zooid (St. WS 783); D, abdomen and post-abdomen of zooid with testis (St. WS 824); E, abdomen and post-abdomen of zooid with ovary but no testis (St. WS 256); F, larva (St. 856).

170–164 m. St. WS 824: Patagonian Shelf, 146–137 m. St. WS 856: Patagonian Shelf, 104 m. St. MS 65: S. Georgia, 39 m.

Colony. Most of the colonies collected from the region of the Falkland Islands and the Patagonian Shelf were rather small, forming rounded or pillow-shaped masses with a flattened lower surface, and were generally under 2 cm. in diameter (Text-fig. 1 A). Sand was present on the surface and also within the colony. The test matrix was clear, rather sparse, and not very tough. The specimens from farther south tended to be larger, attaining a diameter of 7–9 cm., and generally contained less sand (Text-fig. 1 B). There is no obvious arrangement of the zooids in systems, a feature noted also by Pérès (1952), and common cloacal openings could not be seen.

Zooid (Fig. 1 C). Contracted zooids measured 2–5 mm. in length, but must have been longer than this in life.

Thorax. The atrial opening has a characteristic languet (*a.l.*) which is wide and divided into three pointed lobes, of which the central is longest. Another feature which distinguishes the species is the very strong coat of longitudinal thoracic muscles which continue into the abdomen as a narrowing ventral band. (*l.m.*). Transverse muscles are also well developed. There are seven to eleven rows of stigmata, and a series of short languets on the left branchial wall.

Gut. The oesophagus (*oe.*) is narrow and long, and the stomach (*st.*) short, wide, and provided with five or six folds which are usually distinct but sometimes shallow. This number of folds is characteristic of the species, and was noted by Michaelsen (1924), although Sluiter (1900) described a smooth stomach in the type specimen. The remainder of the gut has no distinctive features. Two rounded lobes are present on the anus (*a*), which is situated opposite the 5th row of stigmata in zooids with 8–10 rows.

Gonads. The ovary (*ov.*) is small and placed close below the loop of the intestine, and the testis (*t*) consists of an irregular series of block-like or pear-shaped follicles below the ovary. In some zooids the follicles are condensed to form a compact group (Text-fig. 1 D, *t*) in others (Text-fig. 1 C, *t*) they are extended as usual in the genus and a few zooids show no testes (Text-fig. 1 E). The compact arrangement of the follicles has been regarded as a characteristic of the species (Michaelsen, 1924), but Pérès (1952) noted that in some zooids follicles were also present farther back in the post-abdomen. There is, in fact, variation according to the stage of the reproductive cycle.

Larva (Text-fig. 1 F). Larvae vary from 0·5 to 0·8 mm. in length, measured from the end of the papillae to the base of the tail. There are three rather widely spaced papillae, and between each two, a pair of notched median ampullae (*m.a.*) occur. In most species of *Aplidium* the larva has a single ampulla between each two papillae, but in this species each has evidently divided. The most characteristic feature of the larva is the great development of fringing lateral ampullae (*l.a.*) round the anterior end of the trunk; this fringe clearly distinguishes the larva of *circumvolutum* from all others found in the 'Discovery' collections. Both ocellus and otolith are present. Larvae from subantarctic and antarctic colonies differ only in size (see below).

Comparison of Specimens from the Falkland-Patagonian region with Antarctic Specimens. Table 2 shows the constant differences between specimens from the Falkland Islands and Patagonian Shelf and those from South Georgia and the Palmer Archipelago.

Table 2

	Subantarctic	*Antarctic*
Colony	Small, with rather soft test	Large with firm test
Zooid	Mean length 3 mm., 7 or 8 rows of stigmata	Mean length 5 mm., 10 or 11 rows of stigmata
Larvae	2 or 3 per breeding zooid. Mean length 0·6 mm.	Up to 11 per breeding zooid. Mean length 0·8 mm.

Biology. Table 2 suggests that in its Antarctic range this species has larger colonies, larger zooids with a better developed branchial sac, and larger and more numerous larvae. The inference is that the centre of distribution is in the Antarctic rather than the Subantarctic.

Examination of many specimens showed that all the zooids of a colony keep in phase in their sexual cycle, but that different colonies taken from the same station at the same time differ widely in their sexual state. Thus colonies collected from St. WS 856, on 23 March 1932 varied sexually, as follows:

	No. of colonies
No gonads present	8
Zooids in male phase	3
Zooids in female phase	3
Zooids with embryos	1

The occasional occurrence, in other samples, of zooids with both ovary and testis shows that the sexes are not separate; it is likely that the species is protandrous, as usual in *Aplidium*. The comparative rarity of such zooids, however, suggests that the regression of the testis is rapid after the zooid has functioned as a male. The relatively large number of colonies with zoiods lacking gonads and the absence of gonads in zooids carrying embryos further indicates that the ovary also regresses rapidly after functioning.

Embryos or larvae were present only in colonies collected as follows:

South Georgia	*Falkland Islands*
28. ii. 1926	5. xii. 1931
25. iii. 1926	19. i. 1932
	23. iii. 1932

As the species did not occur in collections made in other months, however, no more can be said than that breeding takes place in the southern summer, with an indication of an earlier start in the Subantarctic than in the Antarctic region.

Remarks. This is a species which shows slight anatomical differences in different parts of its range. A variety described by Pérès (1952) from Kerguelen (var. *kerguelenense*), has each of the oral lobes bifid, and a very wide atrial languet. The differences which I have noted above between the subantarctic and the antarctic specimens in the 'Discovery' collections do not seem to merit systematic distinction.

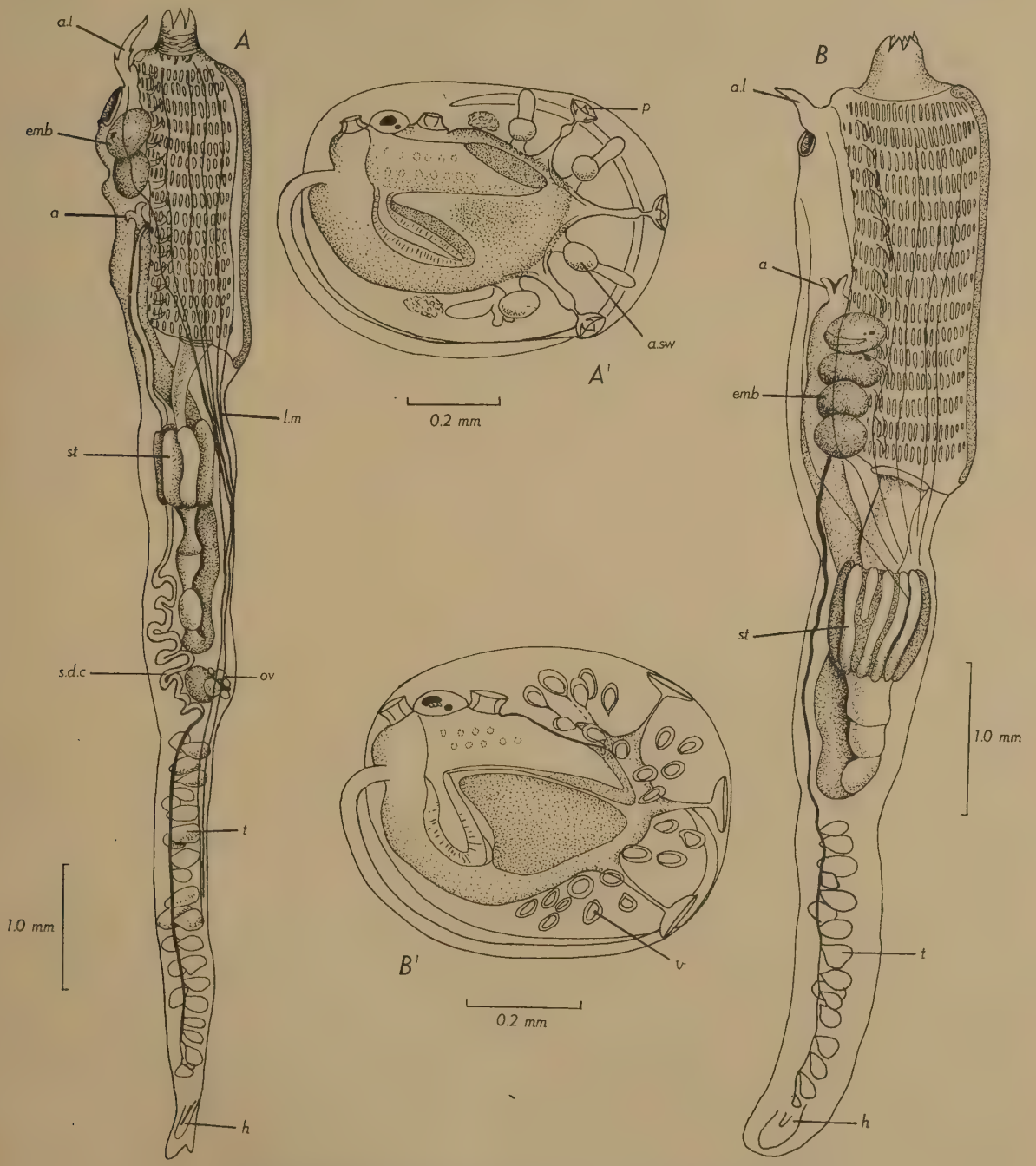
Distribution. New Zealand; Chatham Islands; Subantarctic (Kerguelen, Patagonian Shelf), Antarctic (Graham Land, S. Georgia).

Aplidium fuegiense Cunningham (Text-fig. 2A; Pl. I, fig. 2)

Aplidium fuegiense Cunningham, 1871, p. 66.
For synonymy see van Name, 1945, p. 43.

Occurrence. ?St. 27: S. Georgia, 110 m. St. 51: Falkland Islands, 105–115 m. St. 652: Burdwood Bank, 171–169 m. St. WS 71: Falkland Islands, 82–80 m. St. WS 73: Falkland Islands, 121–130 m. St. WS 76: Patagonian Shelf, 207–205 m. St. WS 79: Patagonian Shelf, 132–131 m. St. WS 80: Patagonian Shelf, 152–156 m. St. WS 83, Falkland Islands, 137–129 m. St. WS 84: Falkland Islands, 75–74 m. St. WS 85: Falkland Islands, 79 m. St. WS 86: Patagonian Shelf, 151–147 m. St. WS 90: Patagonian Shelf, 82–81 m. St. WS 91: Patagonian Shelf, 191–205 m. St. WS 92: Patagonian Shelf, 145–143 m. St. WS 93: Falkland Islands, 133–130 m. St. WS 94: Patagonian Shelf, 110–126 m. St. WS 95: Patagonian Shelf, 109–108 m. St. WS 108: Falkland Islands, 118–120 m. St. WS 219: Patagonian Shelf, 116–114 m. St. WS 220: Patagonian Shelf, 108–104 m. St. WS 233: Falkland Islands, 185–175 m. St. WS 247: Patagonian Shelf, 172 m. St. WS 249:

Patagonian Shelf, 166 m. St. WS 583: Magellan Strait, 14–78 m. St. WS 764: Patagonian Shelf, 110–104 m. St. WS 771: Patagonian Shelf, 90 m. St. WS 775: Patagonian Shelf, 115–110 m. St. WS 776: Patagonian Shelf, 110–99 m. St. WS 781: Patagonian Shelf, 148 m. St. WS 787: Patagonian Shelf, 106–110 m. St. WS 791: Patagonian Shelf, 97–95 m. St. WS 792: Patagonian Shelf, 102–106 m. St. WS 797: Patagonian Shelf, 115–111 m. St. WS 800: Patagonian Shelf,



Text-fig. 2. *Aplidium fuegiense* Cunningham: A, zooid; A[1], larva (St. WS 84).
Aplidium variabile (Herdman): B, zooid; B[1], larva (St. WS 824).

137–139 m. St. WS 801: Patagonian Shelf, 165 m. St. WS 807: Patagonian Shelf, 124–126 m. St. WS 808: Patagonian Shelf, 110–106 m. St. WS 809: Patagonian Shelf, 104–101 m. St. WS 811: Patagonian Shelf, 99 m. St. WS 813: Patagonian Shelf, 106–102 m. St. WS 837: Patagonian Shelf, 102 m. St. WS 841: Patagonian Shelf, 110–121 m. St. WS 847: Patagonian Shelf, 57–84 m. St. WS 871: Patagonian Shelf, 336–342 m. ?St. MS 71: S. Georgia, 110–60 m.

Colony. As van Name (1945) has said, this species is so variable that 'an attempt to describe the colonies in respect to form and size is impossible to fulfill'. Some colonies in the 'Discovery' collections are relatively short and rounded, but many have a very characteristic long form tapering gradually to a fine point at the free end (Pl. I, fig. 2). These long colonies were apparently attached by the lower rounded end to a bottom of sand. The colour of the preserved colonies is usually some shade of orange, yellow or brown, and the zooids sometimes show through the test, but not always. Generally there are no obvious systems of zooids, but in a few cases the zooids could be seen to be arranged in double rows, probably representing narrow oval systems. The surface is usually smooth and without encrusting sand, but the interior of the colony may have a good deal of embedded sand. Some of the

Table 3

Maximum diameter of colony (cm.)	*Mean no. of rows of stigmata*	*Mean no. of folds on stomach*
0·5	18	5
1·5	18	5
2·0	16	5
3·0	17	5
7·0	21	6
7·0	21	5
8·0	22	5
8·0	20	5
9·0	17	5
10·0	18	5
15·0	16	5
28·0	15	5

long narrow colonies appear to have lain horizontally on the sand during life, as sand is adhering to the test at several places along the length of the colony (St. WS 808). In most of the specimens, the surface-layer of the test has a characteristic appearance owing to the presence of many small round pale yellow or orange-coloured vesicles. When the colony is cut open the zooids are seen to be closely spaced. The longest colony in this collection is one of 63 cm. from the Patagonian Shelf (St. WS 808), but one specimen from the same region is recorded as forming a 'portion of a colony weighing 300 g.'.

Zooid (Text-fig. 2A). The length of the zooids in the 'Discovery' material varies a good deal, from about 6 to 18 mm., and depends largely on the development of the post-abdomen. The most characteristic features of the zooid are: (1) the moderately developed and forwardly directed atrial languet; (2) the small atrial opening placed a short distance back along the dorsal side of the thorax; (3) the large branchial sac with ten to twenty-two rows of stigmata; and (4) the stomach with five or six sharply defined undivided longitudinal folds. The number of rows of stigmata and the number of folds on the stomach do not show any clear correlation with the size of the colony, as shown in Table 3.

Gut. Van Name (1945) states that the stomach has usually four to six folds, but sometimes at least eight or ten. Having examined several zooids from each of many colonies in the 'Discovery' collection, I have found the number of folds on the stomach to be always five or six, which I conclude to be the normal number at least in specimens from the Patagonian Shelf. The rest of the gut shows no

diagnostic features. The anus is placed about half way along the branchial sac, opposite the 8th or 9th row of stigmata in zooids with 16 rows. It has two lobes.

Gonads. Mature zooids generally have both ovary (*ov.*) and testis (*t.*). The ovary has a few ova of various sizes and is situated immediately below the intestinal loop. The testis follicles form a long series extending down the post-abdomen. In several colonies, mature zooids had the sperm duct convoluted opposite and just below the intestinal loop (*s.d.c.*). This is not the result of abdominal contraction and the increased length of sperm duct may serve as a reservoir for sperm.

Larva (Text-fig. 2A[1]). The variations in length of the larvae are shown in Table 4.

Table 4

Date	3. ii. 32	6. iii. 27	13. iii. 27	14. iii. 27	14. iii. 31	24. iii. 27	24. iii. 27	1. iv. 32	7. iv. 27
Length (mm.)	0·86	0·70–0·88	0·70	0·70	0·86	0·86	0·70	0·88–0·90	0·66–0·72

All the colonies with these larvae were obtained from the Falkland Islands and the Patagonian Shelf. There is no correlation between length of the larva and the month of the year. The larva is characterized by the rather rounded and robust appearance of the trunk, the widely spaced papillae (*p.*), and the four lateral ampullae on each side, each with a rounded swelling near the base (Fig. 2A[1], *a.sw.*).

Biology. The breeding season is indicated in Table 5 which shows the number of colonies examined in each month in which the species was taken, and also the number of these colonies containing larvae.

Table 5

Month	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
No. of colonies examined	3	3	3	0	0	4	7	36	12	8	14	15
No. of colonies with larvae	0	0	0	0	0	0	0	0	0	1	10	3

When allowance is made for the small number of colonies collected between May and September owing to the difficulty of working during the winter months, it is still evident that the breeding season is limited to a short period in the southern summer and autumn, mainly the months of February, March and April.

Between one and seven larvae were found in the atrial cavity of zooids in different colonies. The zooids with only one larva were smaller than those with several larvae.

An examination of the colonies gives some picture of the annual cycle of growth and reproduction in the species. In December most colonies have well-developed zooids but few have acquired gonads. During the next three months the development of gonads takes place and few colonies were then found which lacked gonads. Breeding follows with the greatest production of larvae in March. Subsequently, the gonads disappear and all the colonies collected in July had de-differentiated zooids representing the normal post-breeding or overwintering condition in species of *Aplidium*.

Remarks. It is difficult to be certain that all the suggested synonyms for this species are reliable, and that all records under the name *A. fuegiense* refer to the same species. Of the reported occurrences in the West Antarctic, those from MacRobertson Land and Enderby Land (Kott, 1954) may not refer to the present species. The colony and zooid described by Kott agree quite well with the specimens from the Magellan region, but the number of folds on the wall of the stomach (8) is rather high. The main difference, however, is the size of the larva, which Kott says is twice that of *A. caeruleum* (Sluiter). The larva of the latter species is, according to Kott's scale drawing, about 1 mm. from the end of the papillae to the base of the tail, which means that the larvae from MacRobertson Land and Enderby Land were about 2 mm. in length. This is a very large larva indeed, and is between two and

three times the size of the larvae of *A. fuegiense* in the 'Discovery' collections, placing it beyond the probable range of variation of that species.

A. fuegiense is, I think, typically a subantarctic species, the 'Discovery' collections providing very many specimens from the Patagonian Shelf and the neighbourhood of the Falkland Islands, and only two doubtful records from elsewhere (South Georgia). The specimens from South Georgia were in a state of de-differentiation, the zooids being reduced to post-abdomens, and the identification is therefore uncertain.

I disagree with van Name (1945) when he says that *A. variable* (Herdman, 1886) is 'very likely synonymous' with *A. fuegiense*. A comparison of the two species is given on p. 33.

Distribution. Subantarctic (Falkland Islands, Patagonian Shelf, Magellan region, coast of Argentina to La Plata); ?Antarctic (South Georgia).

Aplidium variabile (Herdman) (Text-fig. 2B)

Amaroucium variabile Herdman, 1886, p. 216, pl. 29, figs. 7–12, text-fig. 9.
For synonymy see Kott (1954), p. 174.

Occurrence. St. 160: Shag Rocks, 117 m. St. WS 72: Falkland Islands, 95 m. St. WS 91: Patagonian Shelf, 191–205 m. St. WS 93: Falkland Islands, 133–130 m. St. WS 219: Patagonian Shelf, 116–114 m. St. WS 220: Patagonian Shelf, 108–104 m. St. WS 235: Patagonian Shelf, 155 m. St. WS 237: Patagonian Shelf, 150–256 m. St. WS 771: Patagonian Shelf, 90 m. St. WS 772: Patagonian Shelf, 309–163 m. St. WS 781: Patagonian Shelf, 148 m. St. WS 782: Patagonian Shelf, 141–146 m. St. WS 783: Patagonian Shelf, 165–0 m. St. WS 787: Patagonian Shelf, 106–110 m. St. WS 791: Patagonian Shelf, 95–101 m. St. WS 793: Patagonian Shelf, 108–111 m. St. WS 794: Patagonian Shelf, 123–126 m. St. WS 796: Patagonian Shelf, 108–113 m. St. WS 797: Patagonian Shelf, 115–111 m. St. WS 799: Patagonian Shelf, 141–137 m. St. WS 808: Patagonian Shelf, 110–106 m. St. WS 811: Patagonian Shelf, 99 m. St. WS 813: Patagonian Shelf, 106–102 m. St. WS 816: Patagonian Shelf, 150 m. St. WS 824: Patagonian Shelf, 146–137 m. St. WS 838: Patagonian Shelf, 149–159 m. St. WS 847: Patagonian Shelf, 57–84 m. St. WS 857: Patagonian Shelf, 123–124 m. St. WS 865: Patagonian Shelf, 126–128 m. St. WS 869: Patagonian Shelf, 187–201 m. St. MS 64: S. Georgia, 7–15 m. ?St. MS 71: S. Georgia, 110–60 m.

Colony. Colonies of many shapes are present in the collection, the shape depending to some extent on the object to which the colony is attached. The colonies which have been growing on the stems of hydroids tend to be long and narrow and often laterally flattened. Other colonies have apparently been on a sandy bottom and these are usually more globular with a short irregular stalk. Some specimens are slightly lobed. A few colonies have the long narrow finger-like form commonly found in *A. fuegiense*.

The colour in preserved specimens is generally pale buff-yellow, buff, or buff-grey. In most cases the surface is smooth and the colony without sand; although some specimens have a light coating of sand all over, sand, when present, is more often confined to the stalk or basal part of the colony. Usually the zooids show through the test quite distinctly. Definite arrangement of the zooids is seldom apparent, but sometimes they are grouped into small indistinct systems. Usually the zooids lie obliquely to the surface of the colony and not at right angles as in Kott's (1954) specimens. The colonies may reach a length of 12 cm. but are generally under 4 cm. in their greatest dimension.

Zooid (Text-fig. 2B). The length of the zooids varies from 1·5 to 8·0 mm. according to the degree of contraction and the development of the post-abdomen. In large zooids the thorax may attain 3·5 mm. and the abdomen 2·0 mm. Herdman (1886), in his original account, gave 2·5 mm. as the

usual measurement of the thorax and abdomen together, but one of the colonies from the 'Challenger' collection which I have examined has well-expanded zooids with thorax 3·5 mm., abdomen 2·0 mm. and post-abdomen 4·0 mm.

THORAX. The oral siphon is 6-lobed and the atrial siphon has a simple or 3-cleft languet. The branchial sac has from nine to fifteen rows of stigmata.

GUT. The stomach has from ten to sixteen longitudinal folds, generally from twelve to fifteen. One or two of the folds often extend only part of the length of the stomach. The anus has two distinct lips. It is situated opposite the 8th row of stigmata in zooids with fifteen or sixteen rows.

LARVA (Text-fig. 2 B[1]). The larva of this species has not been described. It ranges from 0·58 to 0·70 mm. in length, measured from the end of the papillae to the base of the tail. The trunk is rather deep and stout. The most characteristic feature of the larva is the presence of many small apparently isolated vesicles (*v.*) arranged in a semicircle round the anterior end of the trunk. The three anterior papillae are rather widely spaced and have slender stalks. There are no paired or median ampullae, a feature unusual in species of *Aplidium*. Both ocellus and otolith are present. There are up to ten larvae in the atrial cavity of breeding zooids.

REMARKS. Herdman (1886) pointed out that this species somewhat resembles *A. fuegiense* in external appearance, and Hartmeyer (1911, 1912) also regarded the species as similar. Van Name (1945) stated that they are 'very likely synonymous'. I have examined many specimens of both species, including thirteen colonies of Herdman's type material of *A. variabile*, kindly lent by the British Museum (Natural History). In my opinion the species are certainly separate, and reliable distinctions are found in both zooids and larvae, as shown in Table 6.

Table 6

	Stomach	*Larva*
A. fuegiense	5 or 6 undivided folds	Trunk 0·66–0·90 mm.; paired club-like anterior ampullae; no small isolated vesicles
A. variabile	Usually 10–15 folds, a few of them divided or incomplete	Trunk 0·58–70 mm.; no club-like anterior ampullae; many small isolated vesicles

With regard to these features, the stomach of *A. fuegiense* is very characteristic and I find that the number of folds does not exceed six, even in the largest colonies with fully mature zooids. The 'Discovery' material, therefore, gives no confirmation of van Name's (1945) statement that the folds on the stomach sometimes number at least eight or ten. In the type specimens of *A. variabile* the zooids which I have examined show thirteen to fifteen folds, thus agreeing with Herdman's statement and illustration. Hartmeyer (1911) found fourteen folds, sometimes fewer, and later (1912) stated that the number may be as low as six; he may have been confusing the two species. There is little doubt, however, that the number is generally at least twelve, and Kott (1954) always found fourteen or fifteen folds.

Although there were embryos in one of the type specimens, no fully developed larvae were present, and the larval description is based on 'Discovery' specimens from the Patagonian Shelf. The larvae of *A. variabile* and *A. fuegiense* cannot be confused.

Apart from one record for the Chatham Islands (New Zealand) by Sluiter (1900), *A. variabile* has previously been taken only from Kerguelen, where it seems to be fairly common. Michaelsen (1924) was in some doubt whether to accept the record from New Zealand, and if we ignore it, the previous records were confined to Kerguelen. The wide geographical separation of the previous and the new localities is perhaps not surprising, when it is remembered that the latitude of Kerguelen Island and

the Falkland Islands is almost the same and that many Subantarctic and Antarctic species have a very wide distribution.

DISTRIBUTION. Subantarctic (Kerguelen; Patagonian Shelf; Falkland Islands); Antarctic (Shag Rocks; South Georgia).

Aplidium falklandicum sp.n. (Text-fig. 3, A-H; Pl. I, figs. 3, 4)

HOLOTYPE. St. WS 73, 121–130 m. Length of colony: 19·0 cm.

DIAGNOSIS OF SPECIES. Colonies low, pillow-shaped, globular, or elongate. Systems of zooids oval or elongate. Zooid with atrial languet simple and triangular, or slightly trifid; about seven moderately strong longitudinal muscles; ten to twenty-three rows of stigmata; stomach with five to seven shallow longitudinal folds, or a few indistinct marks or quite smooth. Larva with trunk 0·40–0·70 mm. long; papillae closely spaced, with slender stalks; four narrow median ampullae; about four pairs of lateral ampullae; a dorsal and a ventral lateral series of small vesicles.

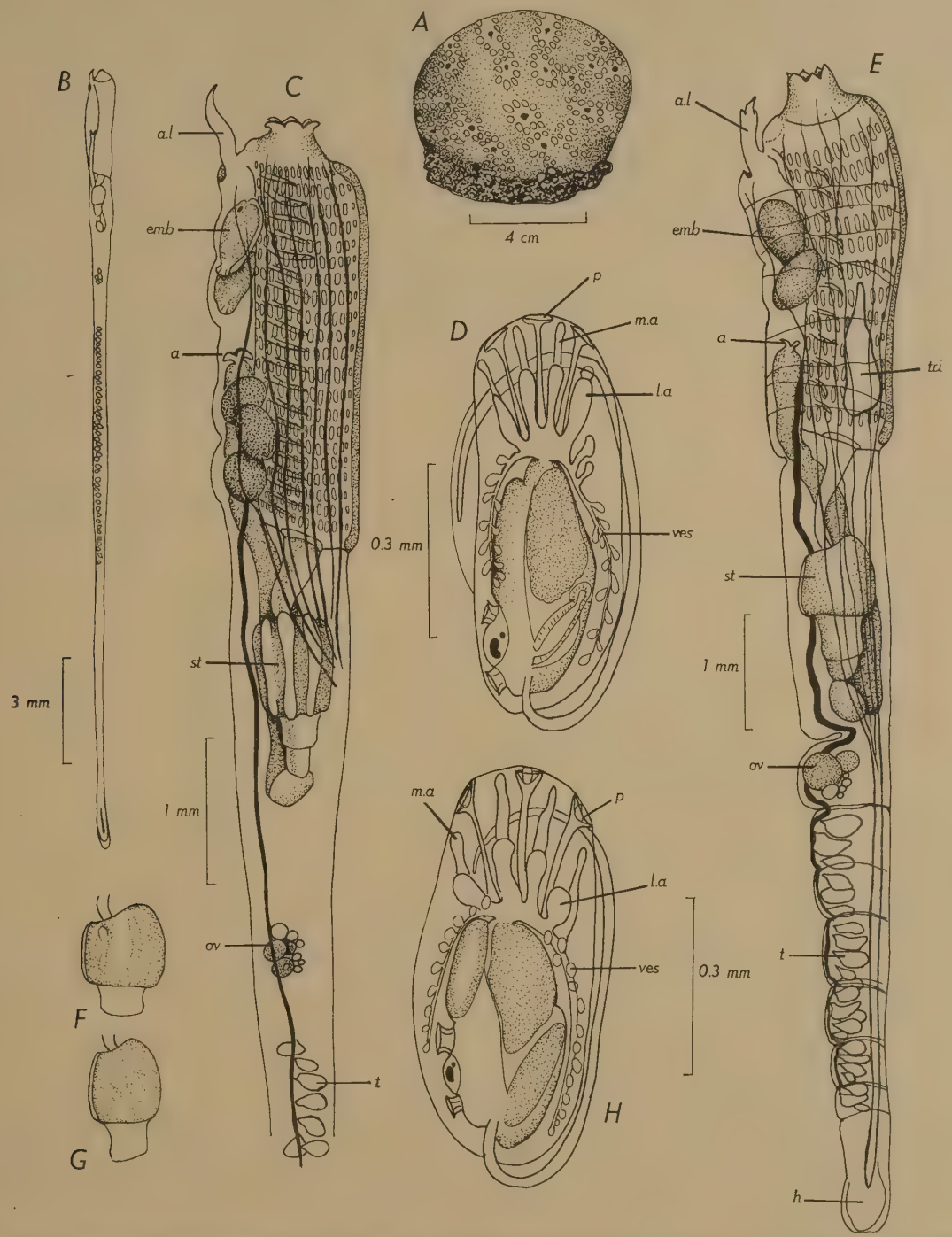
OCCURRENCE. St. 51: Falkland Islands, 105–115 m. St. 53: Falkland Islands, 0–2 m. St. 164: S. Orkneys, 24–36 m. St. 652: Burdwood Bank, 171–169 m. St. 1902: Patagonian Shelf, 50–80 m. St. WS 25: S. Georgia, 18–27 m. St. WS 27: S. Georgia, 107 m. St. WS 72: Falkland Islands, 95 m. St. WS 73: Falkland Islands 121–130 m. St. WS 79: Patagonian Shelf, 132–131 m. St. WS 81: Falkland Islands, 81–82 m. St. WS 84: Falkland Islands, 75–74 m. St. WS 86: Falkland Islands, 151–147m. St. WS 90: Patagonian Shelf, 82–81 m. St. WS 91: Patagonian Shelf, 191–205 m. St. WS 93: Falkland Islands, 133–130 m. St. WS 108: Falkland Islands, 118–120 m. St. WS 154: S. Georgia, 115–0 m. St. WS 182: Palmer Archipelago, 750–520 m. St. WS 219: Patagonian Shelf, 116–114 m. St. WS 220: Patagonian Shelf, 108–104 m. St. WS 222: Patagonian Shelf, 100–106 m. St. WS 239: Falkland Islands, 196–193 m. St. WS 243: Patagonian Shelf, 144–141 m. St. WS 244: Patagonian Shelf, 253–247 m. St. WS 764: Patagonian Shelf, 110–104 m. St. WS 765: Patagonian Shelf, 113–119 m. St. WS 771: Patagonian Shelf, 90 m. St. WS 774: Patagonian Shelf, 139–144 m. St. WS 775: Patagonian Shelf, 115–110 m. St. WS 782: Patagonian Shelf, 141–146 m. St. WS 787: Patagonian Shelf, 106–110 m. St. WS 791: Patagonian Shelf, 97–95 m. St. WS 792: Patagonian Shelf, 102–106 m. St. WS 793: Patagonian Shelf, 108–111 m. St. WS 796: Patagonian Shelf, 106–113 m. St. WS 807: Patagonian Shelf, 124–126 m. St. WS 813: Patagonian Shelf, 106–102 m. St. WS 847: Patagonian Shelf, 57–84 m. St. WS 858: Patagonian Shelf, 132–123 m. St WS 865: Patagonian Shelf, 126–128 m.

COLONY. (Text-fig. 3A; Pl. I, figs. 3, 4.) Colonies vary from low dome-shaped or globular, to ovoid, long or tongue-like masses and often attain a diameter of 6–8 cm. Generally the colony is simple but is occasionally divided into a few lobes. Attachment is sometimes by a broad base, but often by a narrow area, and occasionally a short pedicel is formed. The surface is usually smooth, but sand is sometimes present, especially at the base. Preserved specimens are pale yellow-grey to buff, and a pattern may be formed by the systems of zooids showing through the semi-transparent test. The common cloacal openings are many, small and round. The largest colonies in the collection are about 20 cm. long. In a few specimens there is no apparent place of attachment, and these colonies may have rested freely on the bottom, but most specimens were attached to shells or small stones.

ZOOID (Text-figs. 3B, C, E). In well-developed and expanded zooids the thorax is 1·8–3·0 mm. in length. The abdomen is about the same length or slightly shorter. The post-abdomen varies greatly in length, often exceeds 6 mm. and sometimes reaches 20 mm. (Text-fig. 3B). The thorax is the widest part of the zooid and the post-abdomen the narrowest but the differences in width are slight.

THORAX. There are six pointed oral lobes, and the atrial opening, which lies opposite the first or second row of stigmata, is surmounted by a short triangular simple, or slightly trifid languet (*a.l.*). Six

to eight moderately strong longitudinal muscles are present on each side of the thorax. Zooids from different colonies vary a good deal in the development of the branchial sac, which may have from ten to twenty-three rows of stigmata. Each row generally has twelve to fifteen stigmata. The dorsal languets are quite large. In about half of the specimens the zooids have a conspicuous triangular



Text-fig. 3. *Aplidium falklandicum* sp.n.: A, colony; B, zooid; C, anterior part of zooid with no thoracic triangles; *D*, larva (St. WS 793); E, zooid with thoracic triangles; F, G, stomach of zooids showing indistinct markings; H, larva (St. WS 72).

white area on each side of the body wall near the base of the ventral part of the thorax (Fig. 3 E, *tri.*). Other specimens have no trace of this (Fig. 3 C).

Gut. The oesophagus is usually longer than the stomach and is widest at its branchial end. There is much variation in the stomach. The zooids of some colonies have a stomach with five to seven shallow but distinct longitudinal folds (Text-fig. 3 C), but in other specimens (Text-fig. 3 E, F, G) the folds are reduced to a variable degree, or broken up into a few indistinct swellings or completely absent. In the last case the stomach is like that of *Synoicum*. The intestine and rectum are of the type usual in *Aplidium*. The anus has two small diverging lips; it is situated opposite the 9th row of stigmata when twelve rows are present and opposite the 12th row in zooids with twenty-one rows.

Gonads. The ovary is either close behind the intestinal loop (Text-fig. 3 E, *ov.*) or at some distance from it (Text-fig. 3 C, *ov.*). A long series of small testis follicles (*t*) occupies much of the length of the post-abdomen.

Larva (Text-figs. 3 D, H). The trunk of the larva ranges in length from 0·40 to 0·70 mm. The three papillae are closely spaced and are borne on slender stalks. There are four long narrow median ampullae and four pairs of shorter stouter lateral ampullae. On each side of the dorsal and ventral part of the trunk there is a slender strand of tissue bearing a series of small rounded vesicles (*ves.*). Both ocellus and otolith are present.

Table 7

	Colony	*Stomach*	*Larva*
A. falklandicum	Variable; low to elongate	5–7 shallow folds, or reduction of folds, or smooth	Slender. Trunk 0·40–0·70 mm. Papillae close. Lateral series of dorsal and ventral vesicles
A. fuegiense	Variable; low to elongate	5–7 deep folds	Stout. Trunk 0·6—0·90 mm. Papillae distant. No series of vesicles

Biology. Colonies were collected in all months of the year except August and September, and larvae were found in the subantarctic material in January, February, March, April, June, July, October, November and December. There were no larvae in the antarctic specimens. It appears that the species breeds throughout the year, and in this respect resembles *A. caeruleum* as described by Hartmeyer (1911). The larvae in each breeding zooid number from four to nine.

None of the colonies showed the accumulation of reserve material in the post-abdomen which is commonly found during the post-breeding and overwintering period in many species of polyclinid ascidians. It may be that in species which breed almost continuously throughout the year the de-differentiation of zooids and the accompanying resting phase have been reduced.

Remarks. I have been surprised that this species, which is apparently common round the Falkland Islands and on the Patagonian Shelf, could not be identified with any known species, and I suspect that hitherto it has been confused with *A. fuegiense*, with which it is often collected. A comparison of the two species is shown in Table 7.

It is evident from the table that the larva affords the best characters for distinguishing the species, as will be seen also by comparing Text-figs. 2 A^1 and 3 D, H.

The larva also indicates that specimens possessing white thoracic triangles and those lacking them are both of *A. falklandicum* (see Text-figs. 3 D, H). It unites, too, a whole series of specimens showing structural differences in the stomach, which might otherwise have been thought to indicate specific differences.

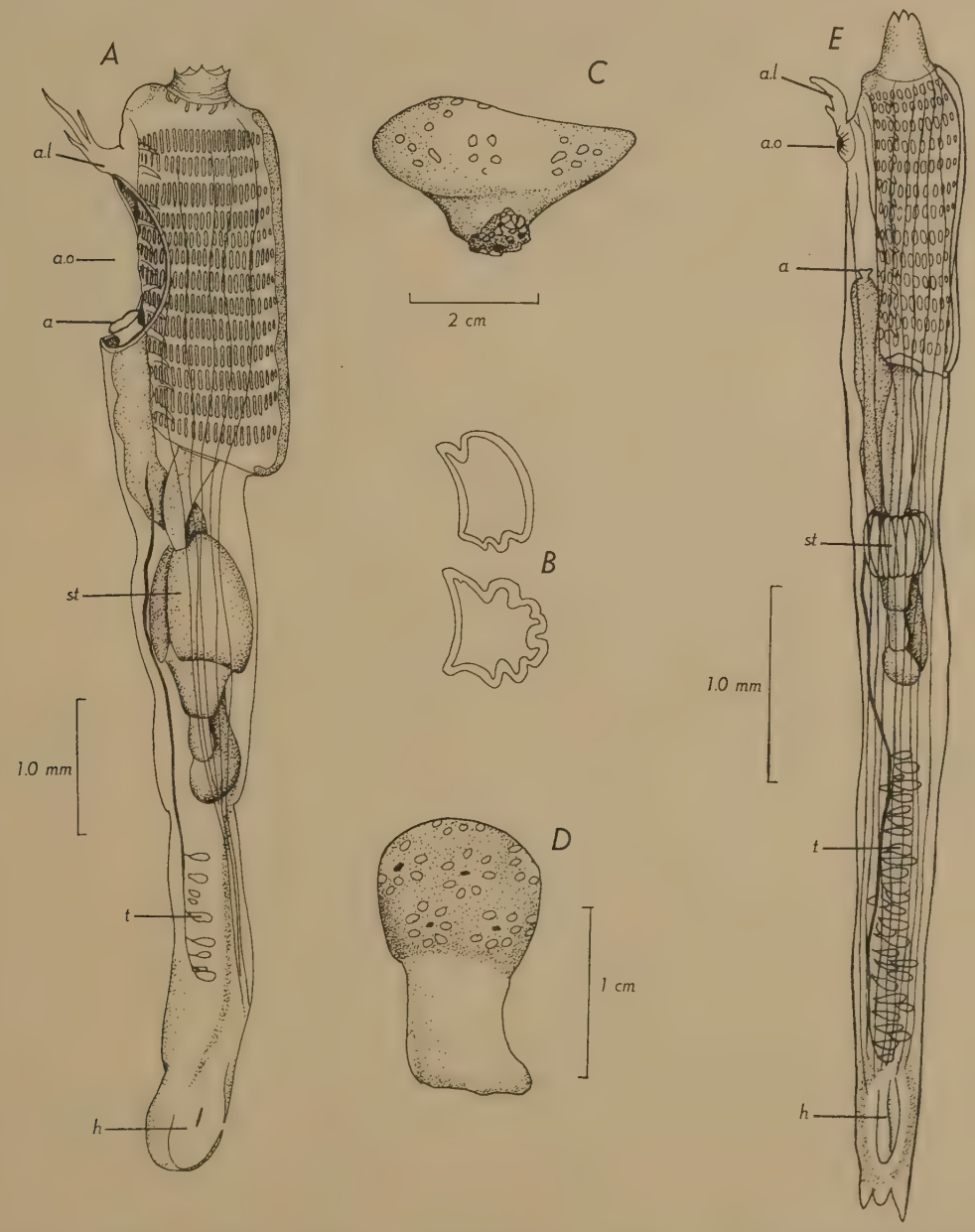
Distribution. Subantarctic (Falkland Islands, Patagonian Shelf); Antarctic (Graham Land, S. Orkneys, S. Georgia).

Aplidium radiatum (Sluiter) (Text-fig. 4A, B; Pl. I, fig. 5)

Psammaplidium radiatum Sluiter, 1906, p. 25, pl. 2, figs. 23, 24; pl. 4, fig. 52.
Amaroucium radiatum Hartmeyer, 1909–11, p. 1471.
Aplidium radiatum Kott, 1954, p. 173.

Occurrence. St. 27: S. Georgia, 110 m. St. 164: S. Orkneys, 24–36 m. St. 181: Palmer Archipelago, 160–335 m. St. 186: Palmer Archipelago, 295 m. St. 190: Palmer Archipelago, 93–126 m.

Colony (Pl. I, fig. 5). Most colonies have a stalk which, in the 'Discovery' material, is always shorter than the head, although sometimes only slightly shorter. In a few colonies there is no stalk,



Text-fig. 4. *Aplidium radiatum* (Sluiter): A, zooid; B, transverse sections of stomach of two zooids (St. 186). *Aplidium seeligeri* sp.n.: C, D, two colonies (Sts. 935, 941); E, zooid (St. 941).

the lower end of the colony merely being flat. The head of the stalked colonies is almost spherical, or ovoid or cylindrical. The general colour of the preserved colony is grey, patterned by the regular double rows of zooids, converging at the apex of the colony, which constitute one of the most characteristic features of the species. The double rows are produced by the adjacent long narrow oval systems of zooids. Each of the systems has a long central cloacal canal, and the canals of most of the systems open into a common depression at the apex of the colony. Although this is the condition generally found in the species, some colonies have, in addition, other cloacal openings scattered over the surface, as observed by Kott (1954). Sand is almost always present within the common test, especially in the superficial layers, but the test material itself is transparent. The largest and smallest specimens in the collection are 6·4 and 1·5 cm. in total length.

Zooid (Text-fig. 4A). The zooid is large and stout, the thorax being about 3 mm. long and the abdomen about the same length; the post-abdomen is variable, and often exceeds the combined length of the thorax and abdomen.

Thorax. The three narrow pointed lobes of the atrial languet (*a.l.*) are always present. Sluiter (1906) noted that the atrial opening is placed a short distance back on the dorsal side of the thorax. The 'Discovery' specimens not only confirm this as a constant feature of the species, but also show that in all well-expanded zooids the opening is of a size unusually great in *Aplidium*, and exposes a large part of the dorsal side of the thorax (*a.o.*). There are thirteen to nineteen rows of stigmata, the number being independent of the size of the colony, at least in the 'Discovery' specimens, all of which are well grown.

Gut. The oesophagus varies in length. According to Sluiter (1906) and Kott (1954) the stomach has four longitudinal folds, but I find a considerable variation in the appearance of the stomach in zooids even from the same colony. In many there are six to eight folds (Text-fig. 4B), but other zooids have a stomach showing no true folds. One or other of these conditions is probably an artifact. The folds, when present, are rather shallow in the 'Discovery' specimens. The undivided anus lies between the 8th and 9th rows of stigmata in zooids with 13 rows.

Gonads. In some colonies zooids were seen with an ovary and in others there was a very slightly developed testis (*t*) in the form of a row of small pear-shaped follicles.

Biology. There is not enough material to give much information on this subject. One specimen taken in March (St. 190) had large eggs in the oviduct and one specimen in the same month (St. 27) had embryos in the atrial cavity, but larvae were not found in any colony. Kott (1954) recorded embryos in January in her specimens from the neighbourhood of Enderby Land, but unfortunately they too were not fully developed. The embryos are very large, according to Kott.

Remarks. Some of the 'Discovery' specimens were taken from near the type locality in the Palmer Archipelago, but others extend the known range of the species to the South Orkneys and South Georgia.

This species has two features unusual in the genus: (1) sharp division of the colony into a head which carries the oral and cloacal openings and a stalk which lacks them; and (2) the openings of cloacal canals from several systems into a common apical depression.

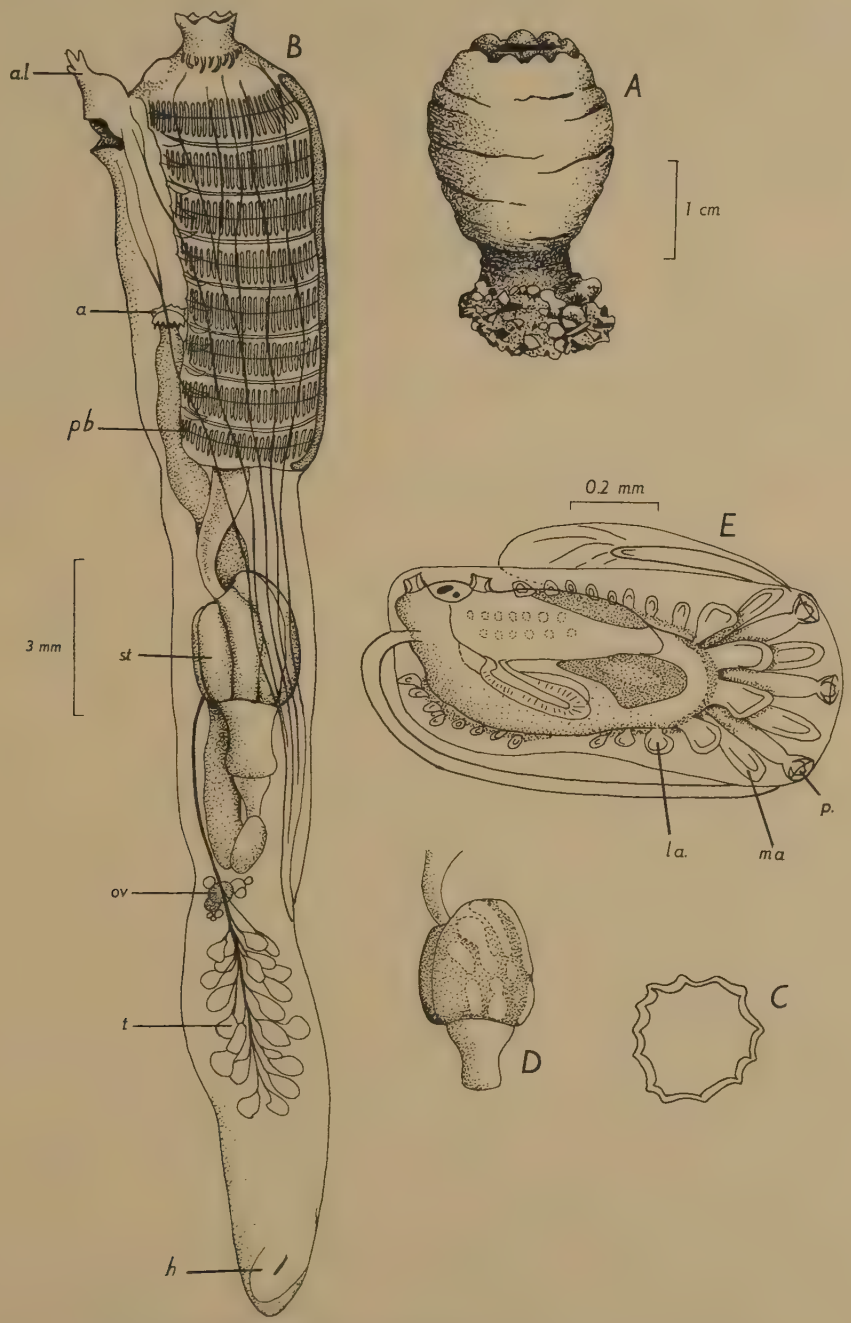
These are both characters found elsewhere principally in species of *Sycozoa*.

Distribution. Western Antarctic (Graham Land, South Orkneys, South Georgia), Eastern Antarctic (Enderby Land).

Aplidium caeruleum (Sluiter) (Text-fig. 5)

Amaroucium caeruleum Sluiter, 1906, p. 16, pl. 1, figs. 13–16; pl. 4, fig. 49.
Aplidium caeruleum Kott, 1954, p. 172, fig. 66.

Occurrence. St. 190: Palmer Archipelago, 93–126 m. ?St. 1563: Marion Island, 113–99 m. St. 1952: S. Shetlands, 376–383 m.



Text-fig. 5. *Aplidium caeruleum* (Sluiter): A, colony; B, zooid; C, transverse section of stomach; D, stomach with low broken folds (St. 1952); E, larva (St. 190).

Colony (Text-fig. 5A). Most of the colonies in the collection show the characteristic shape of a stout club or cone attached by the narrow end. They reach a height of 4 cm. The specimens do not show the blue coloration which gives the species its name; Hartmeyer (1911) also found that much of his material was not blue, but van Name (1945) mentions the colour as being characteristic of most material. The superficial layer of the common test is firm and is impregnated with sand grains, but the test within the colony has no sand and is soft and clear, this being the usual condition in the species. Sand is also lacking immediately round the oral openings of the zooids and round the margin of the common cloacal opening. The zooids are arranged in a single peripheral layer with their oral openings forming a ring round the upper part of the colony, slight swellings marking the position of the zooids. The zooids number up to fifteen in a colony.

Zooid (Text-fig. 5B). Table 8 shows the principle characters of the zooids of the 'Discovery' specimens compared with those described by Sluiter (1906), Hartmeyer (1911) and Kott (1954).

Table 8

	'Discovery'	*Sluiter*	*Hartmeyer*	*Kott*
Atrial languet	3-lobed	Toothed	3-lobed	3-lobed
Oral tentacles	20–30	20	?	?
Stigmata	8 rows, each crossed by a parastigmatic transverse bar; or 16 rows without bars	10 rows	?	16–20 rows, the anterior rows with parastigmatic transverse bars
Stomach	10–13 low folds sometimes broken	8 entire folds and a few short ones	No true folds; instead pigmented lines	Smooth externally; internally with papillae sometimes arranged in rows
Larva	Trunk 1·0 mm. long	Trunk 1·2 mm. long	?	Trunk 1·0 mm. long (measurement taken from fig. 66, Kott)
No. of larvae per breeding zooid	1–11	4 or 5	4 or 5	?

Thorax. The branchial sac is of a kind unusual in *Aplidium* in that parastigmatic transverse bars (*p.b.*) are often present. These cross all the rows of stigmata in some of the 'Discovery' specimens, but in others are entirely absent. As specimens with parastigmatic bars have only half the number of rows possessed by specimens lacking the bars, it is evident that each row crossed by a bar is later divided into two rows. This accounts for the large range in the number of rows. It may also explain the fact that Sluiter noted ten rows of stigmata but eighteen dorsal languets, the additional languets presumably corresponding in position to parastigmatic transverse bars which may have been present in parts of the branchial sac.

Gut. The true structure of the stomach is by no means certain. Deep and well-developed folds are apparently rarely or never present, and are sometimes represented by pigmented lines or rows of internal papillae. In the 'Discovery' specimens the folds are usually undivided (Text-fig. 5B, *st.*), but sometimes broken up (Text-fig. 5D). The anus is opposite the 5th row of stigmata.

Gonads. The gonads have the position usual in *Aplidium*, but the testis follicles (*t.*) are crowded together instead of being biserially arranged.

Larva (Text-fig. 5E). The larva, with a trunk 1 mm. long, is unusually large for species of *Aplidium*. The papillae are not very widely spaced, and have stout stems. Four median ampullae (*m.a.*) are present, and on each side lies a series of lateral ampullae (*l.a.*) which number six according to Kott (1954), but are much more numerous in the 'Discovery' specimens. The lateral ampullae are attached

to a ridge which extends on each side along the dorsal and ventral parts of the trunk. This arrangement is like that described by Carlisle (1952) in *Polyclinum aurantium* Milne Edwards.

The only colonies in the collection with larvae were two taken in March (St. 190); all the larvae from one colony have both ocellus and otolith (Text-fig. 5E), but all those from the other colony lack an ocellus. This is a very curious fact, but as the larvae and the zooids from which they come are identical in all other respects, I cannot doubt that both colonies are of *A. caeruleum*.

According to Sluiter (1906) and Kott (1954) the larvae are contained in a brood pouch, but Hartmeyer (1911) doubted the existence of a special pouch. In the 'Discovery' specimens the larvae were lying in the atrial cavity, as they normally do in species of *Aplidium*.

Biology. It is not possible to add anything regarding the general biology of the species from the scanty material available. Hartmeyer (1911), however, from a study of his rich material, found all stages of male and female ripeness at all seasons, the larvae not being confined to any one period. They were present, for instance, both in January and in July. This is a remarkable case of independence of temperature in the breeding cycle of an antarctic ascidian.

Remarks. The identification of the specimens in the collection is not in doubt, except the single colony from Marion Island (St. 1563). In this colony all the zooids are degenerate and identification rests on the shape and texture of the colony, which closely agree with typical colonies of the species. There must remain considerable doubt, however, especially in view of the more northern latitude of the station.

Distribution. Western Antarctic (Graham Land, South Shetlands), Eastern Antarctic (Kaiser Wilhelm II Land, MacRobertson Land, Enderby Land). (?Marion Island.)

Aplidium stanleyi sp.n. (Text-fig. 6A, B, C)

Diagnosis of species. Colony consisting of low heads arising from a sandy base. Zooids with the atrial opening a little way back along the dorsal side of the thorax. Twelve to fifteen rows of stigmata. Post-abdomen narrow, even with fully developed gonads. Stomach with twenty to twenty-four longitudinal folds. Testis a long series of small follicles.

Occurrence. St. WS 229: Falkland Islands, 210–271 m.

Holotype. St. WS 229: size—12 mm. wide at base, 11 mm. high.

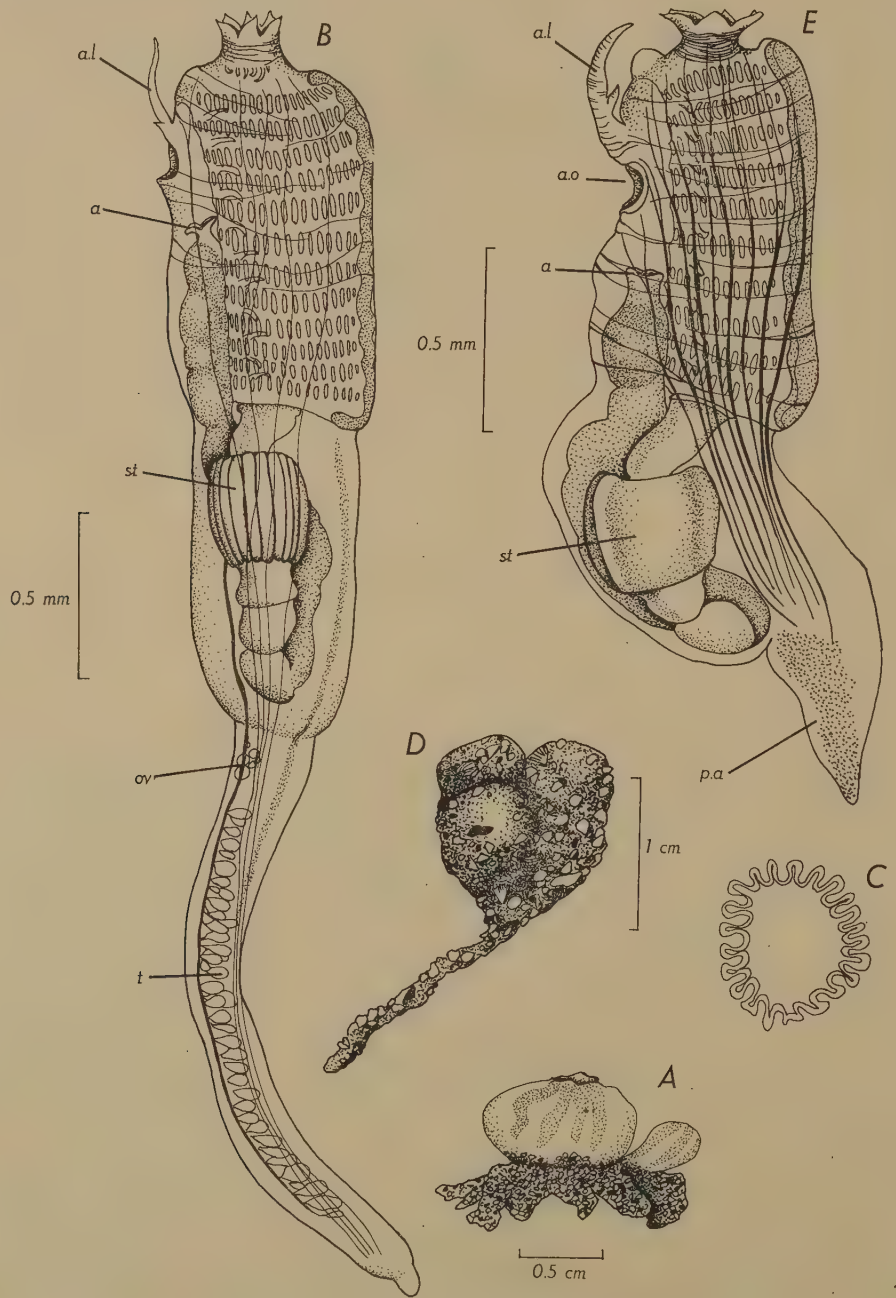
Colony (Text-fig. 6A). This species is represented by many colonies taken in a single haul from the continental shelf round the Falkland Islands. The largest colony is 1·4 cm. high and 1·4 cm. wide. Typically each colony consists of one head or a few heads joined basally, where there is an expansion of the common test which is here heavily impregnated with sand. At its junction with this base, the head is narrowed and the upper part is expanded with a rather flattened or slightly dome-shaped apical end. The test material is sufficiently clear to allow the zooids to show through. They are arranged in a single system in each head, no head having been found with more than one common cloacal opening. The basal sandy test is often produced into a number of finger-like processes or broad lobes, and the colonies appear to have been loosely attached to the sandy substratum.

Zooid (Text-fig. 6B). The zooids are small, averaging about 5 mm. in length, of which the thorax and abdomen account for about 2 mm.

Thorax. The oral siphon has six pointed lobes. The atrial opening is placed a short distance back along the dorsal side of the thorax, opposite to the 3rd row of stigmata, and is a simple round hole, bearing on its dorsal margin a languet (*a.l.*). The languet is sometimes simple and triangular, but more often is divided into a long narrow median lobe and a short pointed lobe at its base on each side. The muscles on the thorax are only moderately well developed. There are from twelve to fifteen rows of stigmata in the branchial sac, each row with about fifteen stigmata.

GUT. The oesophagus is short in all zooids examined, and the stomach (*st.*) barrel-shaped with from twenty to twenty-four narrow close longitudinal folds. The intestinal loop is usually rather short. The anus has two shallow lobes and is situated opposite the 5th or 6th row of stigmata in zooids with twelve rows.

POST-ABDOMEN. In some zooids the post-abdomen is short but when fully grown it is very long and narrow, extending far down into the basal sand-covered test. It is typically very slender, being only half the width of the abdomen.



Text-fig. 6. *Aplidium stanleyi* sp.n. (St. WS 229): A, colony; B, zooid; C, transverse section of stomach. *Aplidium quadrisulcatum* sp.n. (St. 939): D, colony; E, zooid.

Gonads. The ovary is represented in some zooids by a small group of ova in the upper part of the post-abdomen (*ov.*). The testis consists of a long narrow series of many small pear-shaped follicles occupying much of the length of the post-abdomen (*t*). No larvae were found.

Remarks. This species is distinguished from all species of *Aplidium* described from South America, the Subantarctic, and the Antarctic by the following combination of characters: (1) colony small and loosely attached to a sandy substratum; (2) stomach with twenty to twenty-four folds; (3) post-abdomen conspicuously narrower than abdomen.

It most resembles three species from New Zealand: *A. phortax* (Michaelsen, 1924), *A. benhami* Brewin, 1946, and *A. adamsi* Brewin, 1946. From these species it is distinguished by characters (1) and (3).

Distribution. Falkland Islands.

Aplidium quadrisulcatum sp.n. (fig. 6D, E)

Holotype. St. 939: size of colony 1 cm. in diameter.

Diagnosis of species. Colony of variable shape, with sand embedded in the test. Zooids small; oral siphon with six shallow or deep lobes; atrial opening about one-third of the length of the thorax from the base of the oral siphon; atrial languet with 1 median and 2 short lateral lobes; nine to eleven strong longitudinal muscles; 10 rows of stigmata; stomach with four or five indistinct folds.

Occurrence. ?St. 935: North Island, New Zealand, 84 m. St. 939: North Island, New Zealand, 87 m.

Colony (Text-fig. 6D). The colonies from St. 939 are small, the largest being 1·3 cm. in diameter. These colonies vary in shape from flat cushion-like masses to single or lobed ovate heads with a narrow stalk. Sand is present on the surface and throughout the common test, rendering the colonies very firm. Systems of zooids are not visible, but a single common cloacal opening is present in each small colony and on each lobe of the larger colonies. A few specimens from St. 935, which probably belong to this species, reach a diameter of 2·3 cm., and completely lack sand.

Table 9

	Colony	*Longitudinal muscles*	*Rows of stigmata*	*Stomach folds*
A. quadrisulcatum sp.n.	With sand	9–11	10	4 or 5
A. scabellum (Michaelsen)	With sand	1 strong dorsal muscle	20	6
A. nottii (Brewin)	No sand	10–12	14–16	4 or 5
A. novae-zealandae Brewin	With sand	14	14 or 15	4 or 5
A. oamaruensis (Brewin)	With sand	10	16–18	4
A. thomsoni Brewin	With sand	Concentrated on ventral side of post-abdomen	5	5 or 6

Zooid (Text-fig. 6E). The zooid is small, not exceeding 2·0 mm. in length. In most zooids there is no post-abdomen, or a very short one, probably owing to the specimens having been collected out of the breeding season.

Thorax. The short wide oral siphon is divided into six broad, pointed lobes, and the oval atrial opening (*a.o.*), is situated opposite the 3rd and 4th rows of stigmata, that is about one-third of the length of the thorax from its anterior end. There is a triangular pointed atrial languet (*a.l.*) of variable length, with two short pointed lateral lobes near its base. Nine to eleven longitudinal muscles converge on the sides of the abdomen. Ten rows of short stigmata are usually present, with twelve to fifteen in each row.

Gut. The oesophagus is quite wide, and the squat stomach has four or five rather indistinct longitudinal folds. The divisions of the intestine are short. The wide rectum ends in the plain-edged anus opposite the 7th row of stigmata.

GONADS. None of the zooids examined showed any trace of gonads, and no embryos or larvae were found.

REMARKS. The characters of *A. quadrisulcatum* are given in Table 9 for comparison with those of species from New Zealand and the Chatham Islands with which it is most likely to be confused. These species all have a small number of folds on the stomach, but can be separated by other characters.

DISTRIBUTION. North end of North Island, New Zealand.

Aplidium seeligeri sp.n. (Text-fig. 4, C, D, E)

HOLOTYPE. St. 935. Size of colony 4 by 1·5 by 2·5 cm.

DIAGNOSIS OF SPECIES. Colony consisting of a head of variable shape borne on a short stalk. Zooids arranged in small round systems with central common cloacal openings. Zooids with six-lobed oral siphon and a very short atrial siphon surmounted by a triangular languet with two lateral lobes; ten to twelve equally spaced longitudinal muscles; thirteen to sixteen rows of stigmata; oesophagus quite long; stomach with nineteen to twenty-two folds.

OCCURRENCE. St. 935: North Island, New Zealand, 84 m. St. 941: North Island, New Zealand, 128 m.

COLONY (Text-fig. 4C, D). The larger of the two specimens (Text-fig. 4C) is a somewhat flattened mass, 4 cm. long, 2·5 cm. across, and 1·5 cm. in height; the lower part is narrowed to form a short tapering stalk apparently attached to the substratum by a small area. This specimen is buff-coloured in the preserved state, smooth and soft, with the zooids showing through as brown spots. The other colony (St. 941) (Text-fig. 4D) has an almost spherical head and a short stalk rather more than half the diameter of the head. This specimen is 1·5 cm. in total length. The surface is smooth and rather soft, and of a pale dirty buff colour through which the zooids can be faintly seen. In both colonies the zooids are arranged in small round systems of six to twelve zooids, with a small central cloacal opening.

ZOOID (Text-fig. 4E). In well-expanded zooids the thorax and abdomen each measures about 1·8 mm., and the post-abdomen up to 5 mm.

THORAX. Six shallow lobes are present on the oral siphon, and the atrial opening (*a.o.*) is at the end of a very short siphon opposite the 3rd and 4th row of stigmata. There is a short triangular atrial languet with two small lateral lobes near the base. Ten to twelve slender longitudinal muscles are equally spaced round the thorax and continue along the sides of the abdomen and post-abdomen without appreciably converging in the post-abdomen. There are thirteen to sixteen rows of short oval stigmata, with about twelve stigmata in each row.

Table 10

	Colony	*Longitudinal muscles*	*Atrial opening*	*Stigmata*	*Oesophagus*	*Stomach*
A. seeligeri	Stalked	10–12	Short siphon	13–16 rows	Long	19–22 folds
A. phortax	Sessile	13 or 14	Sessile	10–13 rows	Short	23–26 folds

GUT. The oesophagus is more than twice as long as the stomach and narrows at both its upper and lower ends. The stomach is barrel-shaped with nineteen to twenty-two narrow continuous folds. The rectum is wide and ends in a simple anus at the level of the 10th row of stigmata.

GONADS. The post-abdomen of some zooids contains a series of small testis follicles (*t*), with a straight common sperm-duct. No ovary was present, but a few zooids had a single brown egg or developing embryo in the atrial cavity. In these embryos the rudiment of the trunk measured 0·52 mm. in length.

REMARKS. *A. seeligeri* bears more resemblance to *A. phortax* (Michaelsen), a species also found in

New Zealand, than to any other species. The principle characters serving to distinguish these species are shown in Table 10.

DISTRIBUTION. North end of North Island, New Zealand.

The genera *Synoicum* Phipps, *Aplidiopsis* Lahille, and *Polyclinum* Savigny differ from *Aplidium* in having the stomach without longitudinal folds. Their main distinguishing characters are shown in Table 11.

Aplidiopsis is intermediate between *Synoicum* and *Polyclinum*, but is apparently closer to *Synoicum* from which it differs only in having a constriction at the junction of abdomen and post-abdomen. It may be doubted whether this is a character of generic value but I retain *Aplidiopsis* because *A. discoveryi* sp.n. (see p. 51) confirms the generic characters.

Table 11

	Branchial papillae	*Stomach wall*	*Gut loop*	*Post-abdomen*	*Gonads*
Synoicum	Absent	Areolated or smooth	Not twisted	Not narrowed to form a pedicel joining abdomen	Testis compact, sometimes partially surrounding ovary
Aplidiopsis	Absent	Smooth	Not twisted	Narrowed to form a pedicel joining abdomen	Testis compact partially surrounding ovary
Polyclinium	Present	Smooth	Twisted	Narrowed to form a pedicel joining abdomen	Testis compact partially surrounding ovary

Genus Synoicum Phipps, 1774

Synoicum adareanum (Herdman) (Text-fig. 7E; Pl. I, fig. 6)

Polyclinum adareanum Herdman, 1902, p. 195, pl. 22, figs. 1–9.
For synonymy see van Name 1945, p. 59.

OCCURRENCE. St. 175: S. Shetlands, 200 m. St. 1660: Ross Sea, 351 m. St. WS 33: S. Georgia, 130 m. St. MS 71: S. Georgia, 110–60 m.

COLONY. The numerous colonies from St. 1660, in the Ross Sea, are very typical of this species. There is a stalk of variable length with diameter always less than that of the head, but sometimes only slightly less. The stalk is brown, tough, and transversely wrinkled. The head is ovate or roughly conical, smoother than the stalk, grey or pale pink-grey. Systems of zooids are circular and not very large. Kott's (1954) statement that the systems in her specimens were from 20 to 80 mm. in diameter is difficult to understand, as the diameter of the whole head rarely exceeds 100 mm. Sluiter (1906) records a specimen 180 mm. long and 120 mm. in diameter. A large specimen in the 'Discovery' material has the head 70 mm. long and the stalk 30 mm., and another specimen has a total length of 130 mm. This material is therefore among the largest yet recorded. The colonies may be single, but often two stalks arise from a common base. There is an error (possibly typographical) in van Name's statement that Sluiter's (1906) illustration was of a specimen 10 cm. high and 65 cm. in diameter; the diameter should have been 6·5 cm.

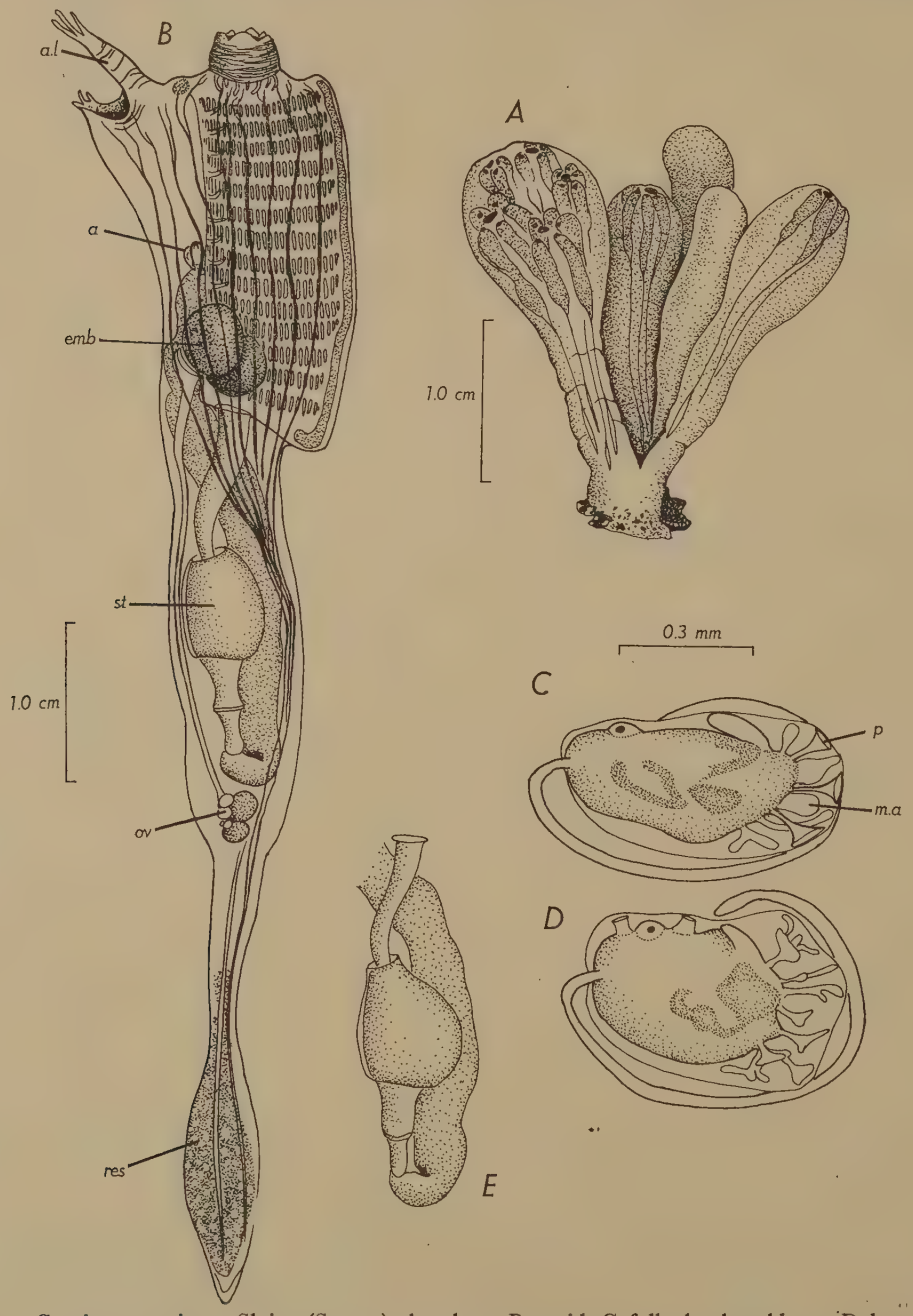
Several small colonies from South Georgia, which I place in this species, also have a short stalk and rounded head with distinct circular systems of zooids. The largest of these colonies is 18 mm. high.

ZOOID. The zooids may attain 12 mm. in length, of which the thorax and abdomen commonly occupy about 4 mm.

THORAX. The number of oral tentacles in several zooids examined varied between sixteen and twenty-four, a number considerably greater than that given by van Name (1945) who recorded about twelve. All zooids examined had eighteen to twenty rows of stigmata, each row with thirty, or a few more, stigmata. Van Name (1945) states that there are 'a dozen or more' stigmata in a row but Kott (1954) found twenty to thirty.

Gut. In uncontracted zooids the stomach (Text-fig. 7E) has a narrow anterior end, is widest just behind the middle and somewhat narrowed posteriorly. The anteroventral margin is slightly concave. In the 'Discovery' specimens the stomach is quite sharply marked off from both the oesophagus and the intestine, although Kott (1954) did not find this in her material. The anus is situated opposite the 13th or 14th row of stigmata and has two lips which are usually reflected.

Remarks. The synonymy of this species is still obscure. According to van Name (1945), *S. georgianum* Sluiter and *S. kohli* Sluiter should probably both be referred to *S. adareanum*, but I believe that



Text-fig. 7. *Synoicum georgianum* Sluiter (St. 149): A, colony; B, zooid; C, fully developed larva; D, larva showing break-up of papillae and ampullae. *Synoicum adareanum* (Herdman) (St. 1660): E, gut

this is not so (see below). If *S. adareanum* extends to South Georgia, and I have here accepted several specimens from that area as *S. adareanum*, the small size of these specimens might be explained by less favourable conditions prevailing on the boundary of the geographical range.

Distribution. Antarctic (Graham Land, South Shetlands, South Georgia, Ross Sea, Kaiser Wilhelm II Land, Enderby Land, Adélie Land, MacRobertson Land), Subantarctic (Kerguelen).

Synoicum georgianum Sluiter (Text-fig. 7 A, B, C, D; Pl. I, fig. 7)

Synoicum georgianum Sluiter, 1932, p. 11, figs. 9, 10.

Occurrence. St. 140: S. Georgia, 122–136 m. St. 144: S. Georgia, 155–178 m. St. 149: S. Georgia, 200–234 m. St. 474: S. Georgia, 199 m. St. 1941: S. Georgia, 55–22 m. St. WS 794: Patagonian Shelf, 123–126 m. St. MS 10: S. Georgia, 26–18 m. St. MS 74: S. Georgia, 22–40 m.

Colony (Text-fig. 7A; Pl. I, fig. 7). The colonies are all small, never exceeding 2·5 cm. in length. Two, three or four heads generally arise from a common base, are narrow in their lower part and gradually widen towards the distal end. Some colonies consist of many small heads attached to a mass of basal, somewhat root-like processes, a condition approaching that described by Sluiter for the type colonies, and in these colonies the individual heads constitute single systems each with an apical common cloacal opening, as described by Sluiter. In other, larger, heads there are up to five round systems of zooids. Usually the surface of the colony is bare, but sometimes there is a coating of sand or broken shell which is confined to the outer layer of the test. The test material is very clear, soft and flexible.

Zooid (Text-fig. 7B). The size and proportions of the zooid are variable, but often the thorax is about 2 mm. long and the abdomen 2 or 3 mm. The post-abdomen is narrow and may be longer than the thorax and abdomen combined. In some zooids the post-abdomen contains reserve material (*res.*) similar to that often stored in the post-abdomen of other polyclinid species.

Thorax. The oral siphon has six lobes, which are sometimes very shallow. The anterior margin of the atrial siphon is elongated into a languet (*a.l.*) almost always provided with three narrow teeth. On the posterior margin there are generally three short teeth.

Branchial sac. Thirteen to fifteen rows of stigmata are present, each with about thirty stigmata.

Gut. The gut is indistinguishable from that of *S. adareanum*, except that the stomach is not pear-shaped, but this is a slight difference. The anus lies opposite the 8th row of stigmata, and is provided with two lips.

Gonads. In two of the specimens collected in December gonads are present. The ovary (*ov.*) is small and compact, with few ova, and lies a short distance below the loop of the intestine, not, as in Sluiter's specimen, overlapping the lower part of the loop. In a few zooids there is a long series of testis follicles below the ovary.

Larva (Text-fig. 7C, D). One colony (St. 144, 5. i. 1927) had fully developed larvae in the atrial cavities of the zooids. These varied from 0·54 to 0·64 mm. in length from the end of the papillae to the base of the tail. In the earlier stages of development (Text-fig. 7C) the three anterior papillae and the four median ampullae were seen together with a few large dorsal and ventral (lateral?) ampullae. In later stages the gut and siphons could be seen and the sensory vesicle containing only a spherical otolith and no trace of the ocellus. Still more advanced larvae (Text-fig. 7D) showed a breaking-up of the papillae and ampullae: this stage may represent the early metamorphosis of larvae retained beyond the normal period in the atrial cavity.

Remarks. In dealing with *S. adareanum* I have already mentioned that *S. georgianum* has been regarded as a synonym (van Name, 1945). Sluiter pointed out, however, in his original description, that the formation of the colony in *S. georgianum* was different, and the colonies described above

confirm this. As these colonies contain mature zooids, they are not to be regarded as young specimens. Corresponding differences in the zooids are more difficult to find, but Table 12 lists the constant distinctions shown by the colony and zooids of the specimens in the 'Discovery' collections.

Table 12

	S. adareanum	*S. georgianum*
Colony	Stalk firm, opaque, wrinkled and sharply marked off from head. Colony massive	Stalk and head not sharply marked off from each other; both transparent. Colony slender
Zooid	18–20 rows of stigmata	13–15 rows of stigmata
	Anus opposite 13th row	Anus opposite 7th or 8th row
	Stomach pear-shaped	Stomach not pear-shaped

Previous accounts do not always bear out these distinctions. Thus the number of rows of stigmata in *S. adareanum* is variously given as ten to twelve (Sluiter, 1906), fifteen to twenty (Kott, 1954), fourteen or fewer up to twenty (van Name, 1945), and about twenty (Herdman, 1902). The relative position of the anus is not clear in previous descriptions, and the stomach has been variously described but was often stated to be contracted. The most reliable distinction appears to be the form and habit of the colony, and accounts of *S. adareanum* agree with most of the characters listed above.

Distribution. Antarctic (South Georgia), Subantarctic (Patagonian Shelf).

Synoicum giardi (Herdman) (Text-fig. 8A; Pl. I, fig. 8)

Morchellium giardi Herdman, 1886, vol. 14, p. 181, pl. 25, figs. 1–3.
Synoicum giardi Hartmeyer, 1911, p. 550, pl. 47, fig. 7, pl. 56, figs. 1–3; Kott, 1954, p. 169, fig. 62.
For other references see Kott, 1954, p. 169.

Occurrence. St. WS 27: S. Georgia, 107 m. St. MS 64: S. Georgia, 7–15 m. St. MS 71: S. Georgia, 110–60 m.

Colony (Pl. I, fig. 8). One colony measures 2·7 by 1·6 cm. in diameter, and about 0·5 cm. in thickness, and is thus rather flatter than the colonies of this species already described by Herdman (1886), Hartmeyer (1911) and Kott (1954). Another colony is 3 cm. long and 1·5 cm. in thickness, being of a low-dome-like shape. The surface of the colonies is smooth, and the colour grey to buff, with star-shaped markings produced by the regular arrangement of the zooids in circular systems. No sand is present on the surface or within the colonies, and the common test is semi-cartilaginous in texture.

Zooid (Text-fig. 8A). The thorax and abdomen together measure about 3 mm. and the post-abdomen is at least as long. Some reserve material (*res.*) was present in the lower part of the post-abdomen of a few zooids, and this part was frequently bent so as to lie almost parallel to the base of the colony.

Thorax. There are six moderately developed lobes on the oral siphon, and the atrial siphon has a simple languet. Twelve to fourteen rows, each with about twelve stigmata, are present in the branchial sac, compared with fourteen to sixteen rows in Hartmeyer's and eighteen in Kott's specimens.

Gut. The gut is typical of the species, with an ovoid stomach having conspicuous areolations which, however, do not project so much as in the specimens described by previous authors. The anus is level with the 8th or 9th row of stigmata.

Gonads. In a few zooids a small ovary (*ov.*) was present at some distance below the end of the intestinal loop, and a few poorly developed testis follicles (*t.*) occurred in a series posterior to the ovary.

Remarks. All the previous records of this species are from the region of Kerguelen, and the 'Discovery' specimens therefore extend the range to South Georgia and suggest that the species may have a wider distribution in the Antarctic.

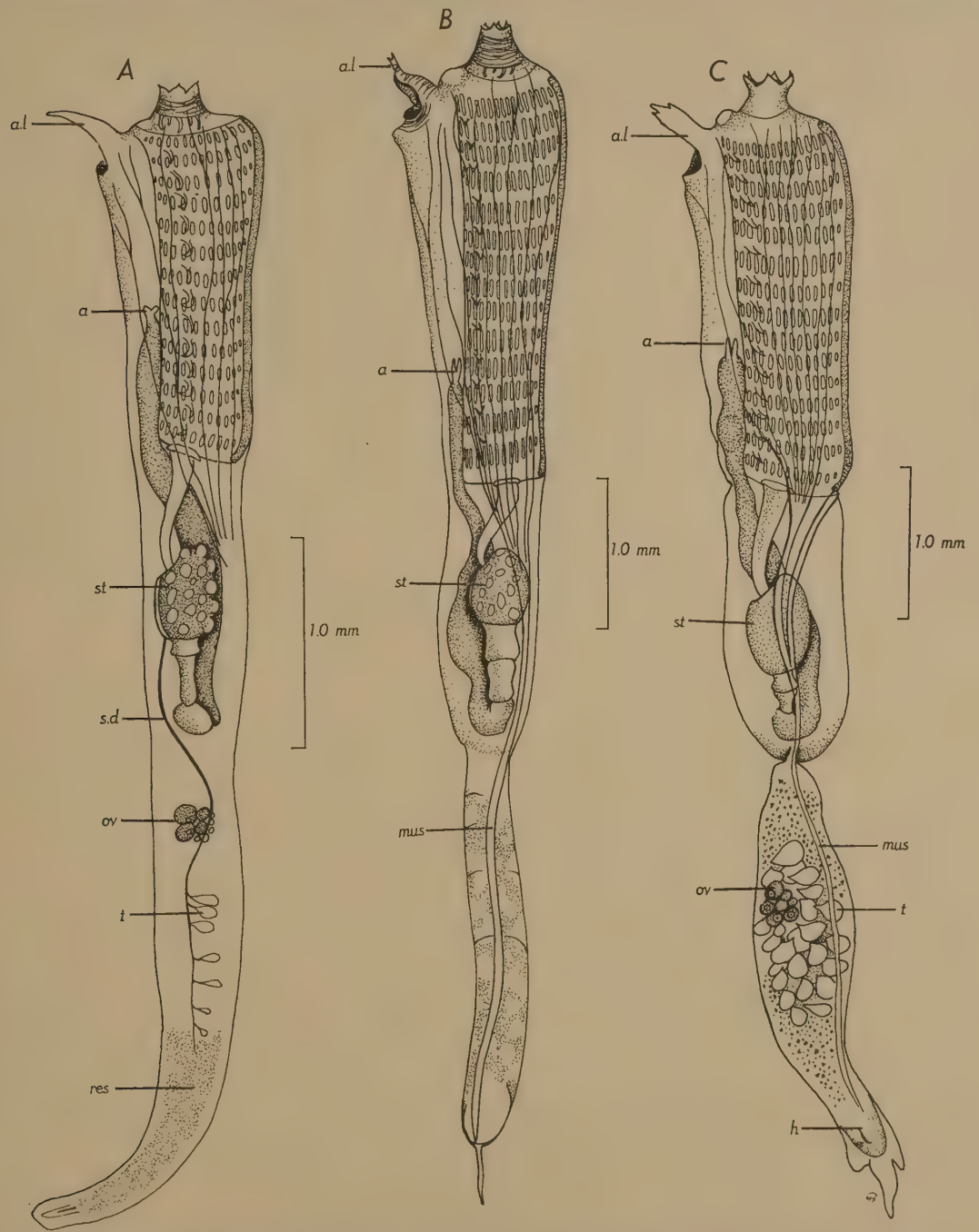
Distribution. Antarctic (South Georgia), Subantarctic (Kerguelen).

Synoicum kuranui Brewin (Text-fig. 8B, Pl. I, fig. 9)

Synoicum kuranui Brewin, 1950, p. 355, text-fig. 1.

Occurrence. St. 935: North Island, New Zealand, 84 m.

Colony (Pl. I, fig. 9). A number of stalked heads are present in the collection, but it is uncertain whether these represent the heads of a single colony or are distinct colonies. The longest of these



Text-fig. 8. *Synoicum giardi* (Herdman) (St. MS 71): A, zooid. *Synoicum kuranui* Brewin (St. 935): B, zooid. *Aplidiopsis discoveryi* sp.n. (St. 941): C, zooid.

pieces is 4·5 cm., of which the head occupies about 1 cm. The average lengths are about 1·0 cm. for the head and 2·5 cm. for the stalk. The head is conical, ovoid, or inverted conical, and has a greatest diameter about twice that of the stalk. The stalk is of uniform diameter except where it expands on joining the head. Both head and stalk have a coating of sand and broken shell, but the coating is thicker on the stalk. The head is fairly soft and the stalk hard. The zooids are arranged roughly at right angles to the surface of the head of the colony. A longitudinal section of the colony shows that the thorax and abdomen of the zooids form a uniform peripheral layer and that the post-abdomens are contained in the core. Sand is relatively scarce in the peripheral layer and densely packed in the core where it occupies most of the space between the post-abdomens. Sand is also abundant within the stalk.

Zooid (Text-fig. 8B). The thorax averages 3 mm. and the abdomen 1·5 mm. in length; the post-abdomen varies greatly and often extends for many millimetres down into the stalk. When preserved in alcohol the zooids are brown.

Thorax. The oral siphon is moderately wide and its rim scarcely lobed. The short atrial siphon is far forward, with a small simple opening, and a strap-like bifid languet (*a.l.*). There may be a small tooth on the posterior margin of the atrial opening. Nine or ten thin longitudinal muscles pass down the sides of the thorax and condense into a strong band (*mus.*) which extends to the end of the post-abdomen. The oral tentacles are slender and few, apparently about eight in number. Fourteen rows of stigmata are usual, each with sixteen to eighteen stigmata. The dorsal languets are short and curved.

Gut. The oesophagus is narrow and curved so that it enters the antero-dorsal side of the stomach. The walls of the stomach are marked by rather few and not very prominent round areolations. Sometimes these are reduced to little more than superficial marks. The anus, which lies opposite the 11th row of stigmata, has two distinct lobes.

Gonads. In none of the zooids was any trace of gonads found, nor were larvae found.

Table 13

	S. kuranui (type material)	*S. kuranui* ('Discovery' material)	*S. arenaceum*
Colony	Capitate heads united by basal mass	Capitate heads, possibly originally united at the base	Cylindrical heads united by basal mass
Atrial languet	Moderate length, with 3–5 short apical lobes	Moderate length with 2 short apical teeth	Long, with 2 or 3 apical teeth
Longitudinal muscles	10–13, slender	9 or 10, slender	About 5, wide
Stigmata	10 rows, each with 14 or 15 stigmata	14 rows, each with 16–18 stigmata	15 rows, each with 12 stigmata
Stomach	Low areolations	Low areolations	Smooth or with faint irregular marks
Gonads	Ovary distant from intestinal loop	Not developed	Ovary distant from intestinal loop

Remarks. Brewin (1950) pointed out the resemblance between this species and *S. arenaceum* (Michaelsen, 1924), but maintained that the zooids differ specifically. Table 13 gives a comparison between Brewin's type material, the 'Discovery' specimens, and *S. arenaceum*.

The similarities between the type specimens and those in the 'Discovery' collection indicate that they are of the same species. It is difficult, with the limited material, to decide whether *S. arenaceum* is a separate species, especially as the 'Discovery' specimens are in some respects intermediate between the type specimens of *S. kuranui* and *S. arenaceum*, e.g. in the number of rows of stigmata.

With the present evidence it seems best to recognize *S. kuranui* and *S. arenaceum* as separate species, while admitting that they may have to be united if more specimens become available.

DISTRIBUTION. Northern part of North Island, New Zealand.

Genus Aplidiopsis Lahille, 1890

Aplidiopsis discoveryi sp.n. (Text-fig. 8C)

HOLOTYPE. St. 941. Size of colony 1·5 × 1·2 × 0·7 cm.

DIAGNOSIS OF SPECIES. Colony of irregular shape, with several common cloacal openings. Zooids with six pointed oral lobes and a wide simple or toothed atrial languet. About fourteen rows of stigmata; no papillae on transverse bars. Stomach smooth; intestinal loop not twisted. Post-abdomen arising from abdomen by a narrow pedicel. Testis follicles in an ovoid or elongated mass but not serially arranged; ovary embedded amongst testis follicles.

OCCURRENCE. St. 941: North Island, New Zealand, 128 m.

COLONY. The colony is an irregular simple mass, not divided into lobes, and broadly attached to a barnacle shell. The common test is semi-transparent, and, there being no sand on or within the test, the zooids are visible. They are arranged in several small systems each with an oval or slit-like common cloacal opening.

ZOOID (Text-fig. 8C). Zooids vary from 4·5 to 7·5 mm. in total length. The thorax is 2–3 mm. long, slightly wider than the abdomen which measures 1·5–2·5 mm. in length; the post-abdomen is generally at least as long as the abdomen. The size of the post-abdomen, however, varies according to the degree of development of the gonads; it is narrow and attached to the abdomen by a short and slender pedicel. Pigment, which in the preserved state is orange in colour, is present on much of the body wall, especially in the post-abdomen.

THORAX. The oral siphon has six pointed lobes, and the round atrial opening, which is opposite the first or second row of stigmata, is surmounted by a fairly wide simple or distally toothed languet (*a.l.*). Eight to ten narrow longitudinal muscles run down each side of the thorax. At the posterior end of the thorax the muscles condense to form a single band on each side, and the left band passes over to the right ventral side of the abdomen where it unites with the right band. The single muscle (*mus.*) thus formed continues into the post-abdomen and ends at its posterior end.

Fourteen or fifteen rows of stigmata are present, each with fifteen to twenty stigmata. The transverse bars bear the pointed triangular dorsal languets, but no papillae.

GUT. The oesophagus is quite long and narrow, and enters the stomach on its oblique antero-dorsal face. The stomach is ovoid, with the anterior end generally wider than the posterior. Two short narrow chambers constitute the post-stomach. The intestine makes a simple loop. The rectum extends to the level of the 10th row of stigmata and ends in a two-lipped anus (*a*).

GONADS. Much of the post-abdomen is occupied by the bulky testis (*t*) composed of numerous pear-shaped follicles. The follicles, instead of being serially arranged as in *Aplidium*, are grouped into an ovoid or somewhat elongated mass as in *Polyclinum*. As in that genus also, the ovary (*ov.*) is a small body embedded amongst the testis follicles. Neither sperm duct nor oviduct could be distinguished in the 'Discovery' specimen.

REMARKS. No other species of *Aplidiopsis* is known from New Zealand. *A. discoveryi* is not likely to be confused with any other species hitherto described.

DISTRIBUTION. North end of North Island, New Zealand.

Genus Protopolyclinum gen.n.

Diagnosis of the genus. A genus of the family Polyclinidae with the atrial siphon opening directly on the surface of the colony, not into a common cloacal cavity; the zooids divided into thorax, abdomen and post-abdomen, the post-abdomen joined to the abdomen by a narrow neck, and containing the gonads and heart, and having muscles in its body wall; the branchial sac with papillae on the transverse bars, and the intestine not twisted as in *Polyclinum*.

Protopolyclinum pedunculatum gen.n., sp.n. (Text-fig. 9, Pl. I, fig. 10)

Holotype. Size: stalk, 12·6 cm.; head, 1·4 cm.

Occurrence. St. 934: North Island, New Zealand, 92–98 m.

Colony (Pl. I, fig. 10). There are four specimens, measuring, including the stalk, 10, 12, 13 and 14 cm. The heads have respectively the following measurements:

Length (mm.)	6, 10, 14, 14
Greatest diameter (mm.)	5, 7, 10, 10

The head of the colony is ovoid, and usually slightly narrower towards the point where it joins the stalk. In the preserved state it is pale yellow grey, and of a soft consistency. In most of the specimens the stalk is widest at its junction with the head, but in the two smallest colonies the greatest width is a little way below the head. The lower half or quarter of the stalk becomes gradually narrower, so that near the point of attachment it has a diameter of only 1 mm. At its widest it may reach a diameter of 4 mm. Immediately below the narrowest part, the stalk expands to form a wider base by which the colony is attached to the substratum. The two smallest heads arise from a single expanded basal mass of test and, although the other two are separate, it is possible that originally all four specimens were members of a single complex colony. The stalk is firmer than the head, especially in its lower half. In its upper part it has the same colour as the head, but the lower part becomes gradually darker and more orange coloured. A series of dark rings round the stalk gives it an annulated appearance.

The zooids are not arranged in systems, and have no apparent order in the head.

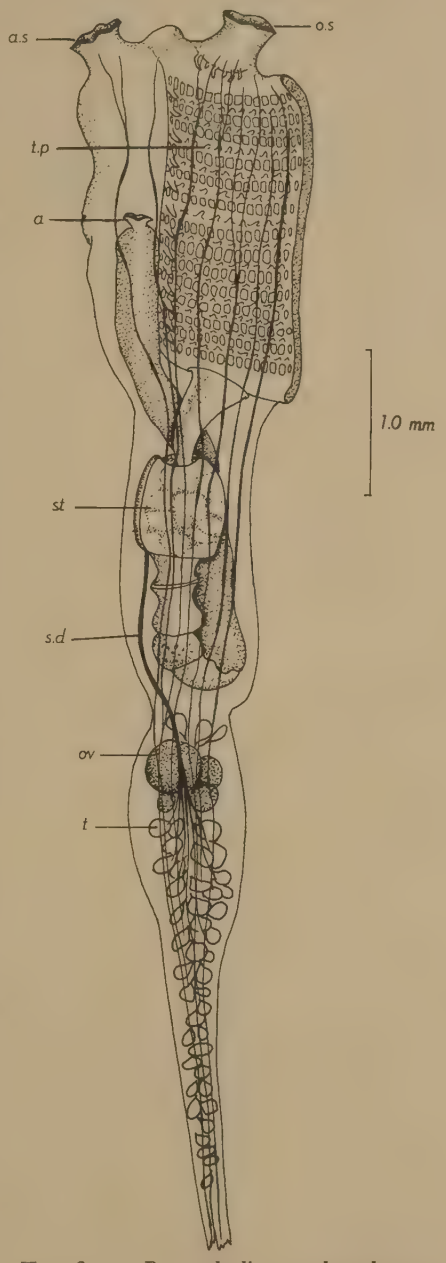
Zooid (Text-fig. 9). The zooid is divided into thorax, abdomen and post-abdomen. In a specimen of average size these measure respectively about 2·7, 2·0 and 4·0 mm.; these lengths do not include the long post-abdominal process which extends for several centimetres down inside the stalk.

Thorax. The thorax is wider than the other two divisions of the zooid. The oral (*o.s.*) and atrial (*a.s.*) siphons are both short and wide, and show no lobes or only very shallow ones. The siphons are placed close together at the anterior end of the thorax. The atrial siphon opens directly on the surface of the colony and not into a common cloacal cavity as in other members of the family Polyclinidae. On each side of the thorax there are about six longitudinal muscles, divided into a few branches at their upper end, and converging as they approach the abdomen. Longitudinal muscles are present not only on the abdomen, but also down the whole length of the post-abdominal process. There are about twelve simple oral tentacles arranged in a single circle at the base of the siphon. The dorsal tubercle is a small ovoid body, with a simple longitudinal slit. The branchial sac has about thirteen rows of stigmata which are rather wide and rectangular and number about sixteen in a row. On the transverse bars of the branchial sac there are small papillae similar to those in the genus *Polyclinum*. The dorsal languets are short and curved.

Gut. The oesophagus is of moderate length and width. The stomach is wide and roughly barrel-shaped, with the walls almost smooth, but showing large, faint areolations or ovoid markings. In some zooids these are outlined by little more than slight irregular transverse ridges. The post-stomach

is divided into two chambers by an expanded ring, and the mid-gut also has two chambers, the first of which has a granulation on the walls. At its junction with the mid-gut the rectum has a pair of small lobes as in other members of the family. The loop of the intestine is not twisted as in *Polyclinum*, and the post-stomach and mid-gut lie on the right side of the rectum as in *Aplidium*. The anus has two lips, and lies about halfway along the length of the branchial sac opposite the 7th row of stigmata.

Post-abdomen. A narrow and very short neck joins the post-abdomen to the abdomen. Below this neck the post-abdomen swells to accommodate the gonads. The ovary (*ov.*) lies near the anterior end of the post-abdomen and has a few ova of various sizes. A few testis follicles lie anterior to the ovary, but most of them are posterior to it (*t*). They are not arranged in a single or double series as they commonly are in *Aplidium*, but instead form, immediately below the ovary, a wide mass which gradually decreases in thickness and passes into the narrow posterior part of the post-abdomen as a single series of follicles. The sperm-duct (*s.d.*) as it passes back over the ovary divides into several smaller ducts which spread out to the testis follicles. Below the level of the testis the post-abdomen continues as a slender process which passes downwards inside the stalk of the colony for a distance of several centimetres. This lower process is divided by a central septum separating the two blood channels. The walls of the process are provided with thin longitudinal muscles. Near the lower end of the post-abdominal process there is often seen an accumulation of cells containing reserve material. At its extreme lower end is the heart, a simple U-shaped tube.



Text-fig. 9. *Protopolyclinum pedunculatum* gen.n., sp.n. (St. 934): Zooid.

Larva. Some zooids in one colony contained a few larvae which unfortunately were not, I believe, fully developed. The most advanced of these larvae measures about 0·7 mm. from the end of the papillae to the base of the tail. There are three anterior papillae, flanked on each side by a row of four rounded ampullae. No epidermal vesicles are present at the stage of development represented by these larvae. There is an ocellus and an otolith. The tail when coiled round the larva reaches to about the sensory vesicle.

Remarks. With the exception of the atrial siphon which opens directly to the exterior, all the characters of this interesting genus indicate that it should be placed in the subfamily Polyclininae. The existence of branchial papillae and the form of the post-abdomen suggest a systematic position closer to *Polyclinum* than to *Aplidium*. But it is separated from *Polyclinum*, not only by the absence of common cloacal cavities, but also by the presence of muscles on the wall of the post-abdomen. *Protopolyclinum* probably branched off from the primitive *Polyclinum* stock after that stock had acquired its main characters, but before all of them had been fixed as we know them in recent species. Thus the loss of

post-abdominal muscles had not occurred and probably the arrangement of zooids in systems with common cloacal cavities had not yet been acquired. It is possible, however, that common cloacal cavities were originally present and subsequently lost, but this seems unlikely for the possession of these structures must be assumed to be useful as they are a common feature in several unrelated groups of compound ascidians. If these assumptions about the origin of *Protopolyclinum* are correct, the two main lines of the Polyclininae typified by *Polyclinum* and *Aplidium* respectively must have acquired common cloacal cavities independently of each other, an interesting case of convergent evolution.

The presence of a stalk shows a degree of specialization which finds a parallel not in the Polyclinidae but in the Polycitoridae, where *Sycozoa* has a similar form.

Distribution. North end of North Island, New Zealand.

Subfamily Euherdmaniinae Seeliger, 1906

Genus Ritterella Harant, 1931

Harant (1931) created the genus *Ritterella* for a species described and named by Ritter & Forsyth (1917) as *Amaroucium aequali-siphonalis*. This genus differs from *Aplidium* (syn. *Amaroucium*) only in having the two siphons equal and both opening directly on the surface of the colony. Oka (1933) created the genus *Sigillinaria* for a species *S. clavata*, the genus being distinguished from *Aplidium* by the same single character. *Sigillinaria* is therefore a synonym of *Ritterella*. This is not always recognized, and some authors use the name *Sigillinaria* (van Name, 1945; Brewin, 1950), while others use *Ritterella* (Huus, 1933, Tokioka, 1953).

Ritterella vestita sp.n. (Text-fig. 10)

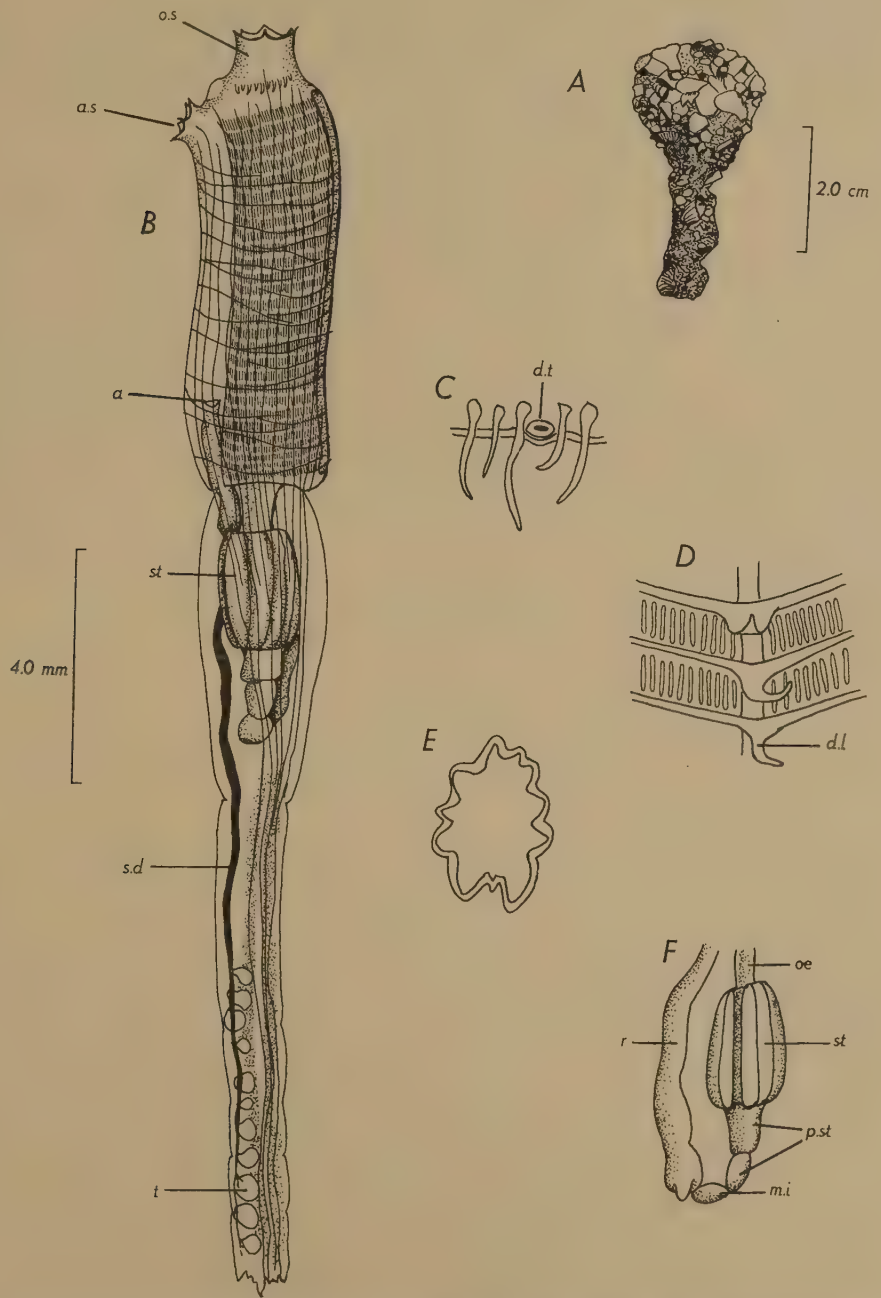
Diagnosis of species. Zooids completely embedded; oral and atrial siphons each with six shallow pointed lobes and both opening directly on the surface; about twenty-four simple oral tentacles; dorsal tubercle with a simple transverse opening; twenty-seven to thirty-four rows of stigmata; stomach with eight to ten longitudinal folds; testis follicles in a long series in the post-abdomen.

Occurrence. St. 934: North Island, New Zealand, 98–92 m.

Colony (Text-fig. 10A). The single specimen, the holotype, which is probably incomplete, consists of a stalk 2 cm. long and about 0·4 cm. in diameter, from the end of which a triangular, expanded head arises, about 2 cm. long and 2·4 cm. wide at the distal end, where the width is greatest. The whole specimen is rough and mottled grey, its appearance being due to the heavy layer of encrusting broken shell which completely covers the test. The common test itself is clear and the shell is confined to the surface.

Zooid (Text-fig. 10B). The zooids are entirely embedded in the common test and show no arrangement in systems. When exceptionally well expanded the thorax measures about 8 mm., but in most zooids it is more or less contracted and may then measure less than 4 mm. in length. The abdomen is between 2 and 4 mm. long, and the post-abdomen may exceed 10 mm. In the preserved state the zooids are dull orange in colour. The wide oral siphon (*o.s.*) is terminal, of moderate length, and has six shallow pointed lobes. The atrial siphon (*a.s.*) lies a short distance back along the dorsal side of the thorax; it also opens on the surface, is short and wide, and has six pointed lobes. The body wall is rather thick and opaque, with up to twenty-five slender longitudinal muscles and many slender circular muscles. The longitudinal muscles converge in the sides of the abdomen and continue along the whole length of the post-abdomen.

Branchial sac. There are about twenty-four simple oral tentacles of alternating sizes (Text-fig. 10C). The dorsal tubercle is very simple and has an oval transverse slit (Text-fig. 10C, *d.t.*). Twenty-seven to thirty-four rows of narrow stigmata are present, each row usually containing forty to fifty stigmata. There are no parastigmatic transverse bars. The hooked dorsal languets (Text-fig. 10D, *d.l.*) are wide at the base and taper rapidly to a point. The languets towards the posterior end of the branchial sac become progressively larger.



Text-fig. 10. *Ritterella vestita* sp.n. (St. 934): A, colony; B, zooid; C, oral tentacles and dorsal tubercle; D, part of roof of branchial sac, showing dorsal languets; E, transverse section of stomach; F, part of gut.

Gut (Text-fig. 10F). The oesophagus is wide, and shorter than the stomach. The stomach is longer than wide, slightly laterally compressed, and has eight to ten uninterrupted longitudinal folds. There are two divisions of the post-stomach (*p.st.*) which together are shorter than the stomach. The mid-intestine (*m.i.*) is a short chamber lying horizontally at the lowest part of the gut loop. At its junction with the mid-intestine the rectum (*r*) bears a pair of caeca. The rectum passes directly up to the base of the thorax where it ends in a simple anus situated opposite the 22nd row of stigmata in zooids with twenty-eight rows.

Gonads. No zooid examined had an ovary. A testis was present in a few zooids and constituted a series of rounded follicles (*t*) occupying much of the length of the post-abdomen. The sperm duct (*s.d.*) leads straight forward towards the base of the thorax, but its terminal part could not be seen.

Remarks. Four species of *Ritterella* have been described from the waters surrounding New Zealand and as Table 14 shows, these are all clearly different from the present species.

Table 14

	No. rows stigmata	*Oesophagus*	*Stomach*
R. novae-zealandiae (Brewin)	3, each of 21–25	Much longer than stomach	Smoooth
R. opaca (Brewin)	3, each of 9 or 10	Much longer than stomach	4 folds
R. aurea (Brewin)	3, each of 15–17	Much longer than stomach	3 or 4 folds
R. arenosa (Brewin)	9 or 10, each of 20–24	Short	Smooth
R. vestita sp.n.	27–34, each of 40–50	Shorter than stomach	8–10 folds

Other species of *Ritterella* are known from Kamchatka and Sakhalin (*R. clavata* (Oka)), from Japan (*R. pedunculata* Tokioka, *R. yamazi* Tokioka) and from the west coast of North America (*R. pulchra* (Ritter), *R. aequali-siphonalis* (Ritter & Forsyth)). All of these species, however, are quite distinct from *R. vestita*.

The genus, as known at present, is confined to the Pacific Ocean.

Distribution. North Island, New Zealand.

Family DIDEMNIDAE Giard, 1872

Genus Didemnum Savigny, 1816

Didemnum studeri Hartmeyer

Didemnum studeri Hartmeyer, 1911, p. 538.

Occurrence. St. 56: Falkland Islands, 10·5–16 m. St. 399: Gough Island, 142–102 m. St. WS 246: Falkland Islands, 267–208 m. St. MS 71: S. Georgia, 110–60 m.

Colony. The preserved specimens are dirty white or pale buff grey. They are thin encrusting sheets, some of them investing the tubes of worms, and may reach 7 cm. in greatest diameter. There are a few inconspicuous common cloacal openings. The spicules range from 10 to 40 μ in diameter and most are under 20 μ. The rays are irregular and short, and some spicules are almost spherical in outline.

Zooid. The zooid has a rather larger atrial opening than has been described in previous accounts; there is no atrial languet or at most a small upper lip over the opening. A long slender retractor process extends downwards from the lower end of the thorax.

Gonads. No ovaries are developed in these specimens. The structure of the testis in the 'Discovery' material is, in Table 15, compared with previous accounts.

Distribution. Subantarctic (Kerguelen, Magellanic region, Chatham Islands, Aukland, Stewart Island, Macquarie Island, Tasmania, Gough Island, Falkland Islands), Antarctic (South Georgia).

Remarks. In spite of certain differences in detail, particularly in the testis and sperm duct, the

'Discovery' specimens belong, without much doubt, to *D. studeri*. The nearest existing records of the species are from Tierra del Fuego and the Strait of Magellan. It is not surprising to find it at the Falkland Islands, but the record from Gough Island is considerably farther north, where the temperature at 150 m. is about 4° C. higher.

Table 15

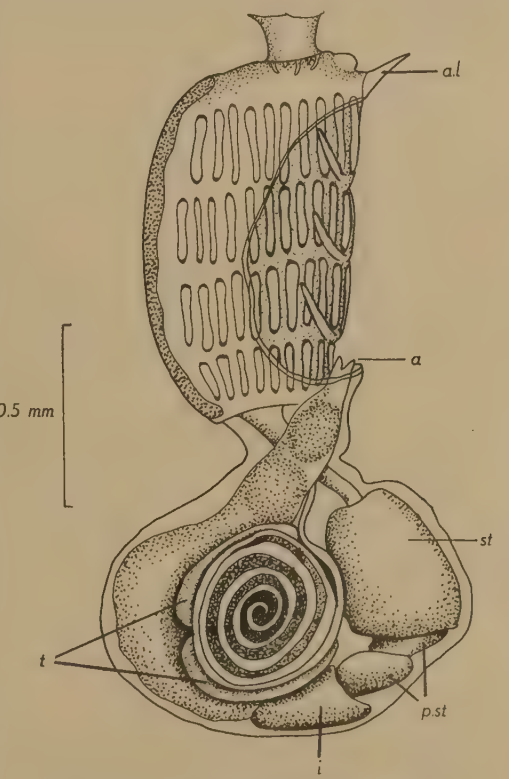
	'Discovery'	*Hartmeyer* 1911	*Michaelsen* 1919	*Kott* 1954
No. of follicles	2–4	3	2–3	3
No. of spiral turns	4–7	At least 7	7–8	7–10

Didemnum biglans (Sluiter) (Text-fig. 11)

Leptoclinum biglans Sluiter, 1906, p. 29, pl. 2, figs. 27, 28.
For synonymy see Kott, 1954, p. 159.

Occurrence. St. 182: Palmer Archipelago, 273–500 m. St. 187: Palmer Archipelago, 259–354 m.

Colony. The colony from St. 182 is attached to the sandy tube of a worm, and measures about 5 cm. in length. It is thick and fleshy, and, preserved, is of a pale buff-grey colour, the zooids forming paler spots on the surface. Four round or oval common cloacal openings are found scattered over the surface of this colony. Although the zooids are grouped there is no very obvious arrangement in systems. No spicules whatever are present in the common test, but the superficial layer has round empty spaces very like the cavities occupied by spicules in other didemnids, and I am inclined to believe that this colony may originally have had a layer of spicules near the surface and that these have been destroyed after the specimen was collected, possibly by acid in the preserving liquid. This explanation of the superficial empty spaces is supported by Sluiter's (1906) statement that no vesicular cells are present in this species. On the other hand, it may be that the colony had no spicules in life. Within the colony there are very large cavities, especially in the upper half of the test, the thoraces of the zooids being contained in strands of test which pass from the upper layer down to the basal layer of common test, a condition very like that found in *Diplosoma*.



Text-fig. 11. *Didemnum biglans* (Sluiter) (St. 182): Zooid.

The specimen from St. 187 is in all essentials like that from St. 182, but is smaller and was growing on the test of a specimen of *Pyura discoveryi*.

Zooid (Text-fig. 11). The zooids are small, having an average length of 2 mm. The oral siphon is short with six indistinct lobes. Much of the dorsal surface of the branchial sac is exposed by the large atrial opening which extends, in well-expanded zooids, from the 1st to the 4th row of stigmata. The opening is surmounted by a short triangular atrial languet (*a.l.*). There is no trace of lateral thoracic organs.

Branchial sac. Ten to twelve long stigmata are present in each of the four rows. The stigmata are generally of the width shown in Text-fig. 11, but in a few exceptionally well expanded zooids they are much wider and rectangular in shape. The three dorsal languets are long, and usually forwardly directed.

Gut. The oesophagus is narrow and about as long as the stomach, which is a wide barrel-shaped organ. The post-stomach is about equal in length to the intestine, and the wide rectum ends in a two-lipped anus situated at the base of the thorax, opposite the 4th row of stigmata.

Gonads. In most zooids the ovary is not developed, and when present it is represented by one large ovum, and a group of smaller ova. The testis consists of two or three rounded follicles (*t.*) on the surface of which the sperm-duct makes four to six spiral turns.

Developing embryos were present in the common test below several of the zooids, but none had reached the larval stage.

Remarks. I have had some difficulty in deciding the identity of these specimens, mainly owing to the complete absence of spicules. This feature may be an artifact, as suggested above, or may represent the extreme reduction of spicules which previous authors (van Name, 1945; Kott, 1954) have noted as being scarce in some colonies which they examined. It is relevant that considerable variation is known in the abundance of spicules in other species of Didemnidae (e.g. *Trididemnum tenerum* (Verrill), van Name, 1945, Berrill, 1950; *T. opacum* (Ritter), van Name, 1945; *Didemnum helgolandicum* Michaelsen, unpublished personal observation).

Table 16

Spicules	*'Discovery'* Absent	*Sluiter* Common only in upper layer	*Hartmeyer* As Sluiter's description	*van Name* Usually common in upper layer, sometimes very few	*Kott* Mainly in upper layer, nowhere dense
Atrial opening	Large	?	Small	?	?
Lateral thoracic organs	Absent	Present	Present	Present	Present
No. of stigmata per row	10–12	?	?	10–12	?
No. of testis follicles	2 or 3	1	2	?	2
No. of turns of sperm duct	4–6	3	3–4	?	4–5

A comparison of the 'Discovery' specimens with the descriptions given by Sluiter (1906), Hartmeyer (1911), van Name (1945) and Kott (1954) is given in Table 16.

The differences shown above seem less important than the similarities, especially considering the doubtful nature of the absence of spicules, and I conclude that the colonies are within the probable range of variation of *D. biglans*.

Distribution. Antarctic (Graham Land, Enderby Land, Kaiser Wilhelm II Land).

Didemnum trivolutum sp.n. (Text-fig. 12)

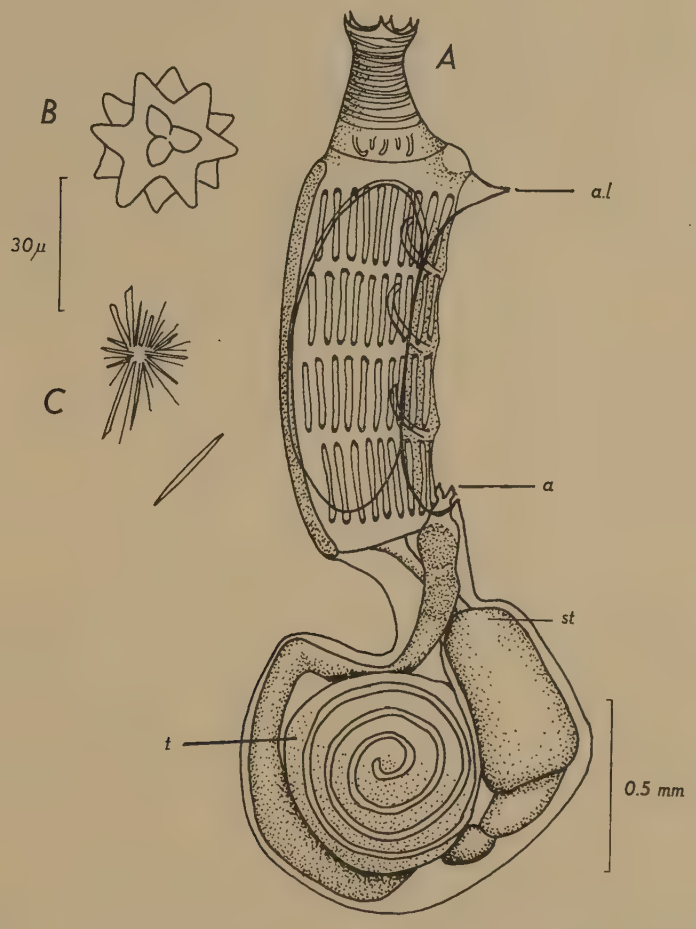
Holotype. St. WS 811.

Diagnosis of species. Colony thin and encrusting, with spicules densely packed throughout the whole depth of the test. Spicules of a regular stellate shape, 20 to 40 μ in diameter with eight to twelve rays in optical section; also some spicules with very thin needle-like rays. Zooid with wide, long atrial opening, surmounted by a languet; lateral thoracic organs large; stomach rather rectangular; testis undivided, with sperm-duct making three spiral turns.

Occurrence. St. WS 99: Falkland Islands, 251–225 m. St. WS 811: Patagonian Shelf, 99 m.

Colony. The specimens consist of large sheeting masses, sometimes growing round the tubes of worms, and reaching a length of 10 cm. The average thickness of the colony is 3 mm. In colour the

preserved colonies are generally pale grey or almost white, with a pattern of darker spots marking the positions of the zooids. A few slit-like common cloacal openings are present on the surface. All parts of the common test are crowded with spicules, which are present even in the most superficial layer, there being no bladder cells such as are often found in the uppermost layer of the test in didemnids. The spicules are mostly of a regular stellate form, reaching 40 μ in diameter and having from eight to twelve pointed conical rays in optical section (Text-fig. 12 B). A few spicules were also seen consisting of bundles of very thin needle-like rays arranged in a stellate pattern, these spicules also being 30–40 μ in diameter (Text-fig. 12 C). A system of common cloacal canals lies a little above the middle level of the colony.



Text-fig. 12. *Didemnum trivolutum* sp.n. (St. WS 811): A, zooid; B, C, spicules.

Zooid (Text-fig. 12 A). The thorax is about 1·6 mm. long and the abdomen about 1·0 mm. The prominent oral siphon has six pointed lobes. A large part of the dorsal side of the thorax is exposed by the atrial opening which extends at least half the length of the thorax and often extends almost the whole length. On the anterior border the opening bears a short triangular languet (*a.l.*). There are large oval lateral thoracic organs with associated masses of small spicules. These organs occupy most of each side of the thorax.

Branchial sac. There are about eleven long narrow stigmata in each of the four rows. The three dorsal languets are long, curved, and directed anteriorly.

Gut. The oesophagus is narrow and the stomach (*st.*) large with a somewhat rectangular outline. The post-stomach is generally quite long and conical, but is sometimes short. The intestine is short and narrow. The rectum is wide at its lower end but soon narrows. The narrow part is bent into an S-shaped curve. The anus, which is situated at the base of the thorax, opposite the 4th row of stigmata, has two shallow lips.

Gonads. The testis (*t*) is undivided and the sperm duct makes three spiral turns round it. In some colonies only the ovary was developed.

Remarks. *D. trivolutum* somewhat resembles two other species from South American waters, *D. tenue* (Herdman) and *D. chilense* Ärnbäck. The characters which most readily separate *D. trivolutum* are listed in Table 17. In this comparison the characters of *D. chilense* were taken from Ärnbäck (1929, fig. 5), and the diameter of the spicules of *D. tenue* was measured in specimens of Herdman's original material kindly lent by the British Museum (Natural History).

It will be seen that *D. tenue* and *D. chilense* are not distinguished from each other by the characters listed. But Ärnbäck, having compared material of the two species, was satisfied that, in spite of similarities 'the differences are more essential, lying in the form of the zooids, which are not very elongated but larger in the species *tenue*, having a short atrial languet, a longer and more sharply curved intestinal loop'.

Table 17

	D. trivolutum	*D. tenue*	*D. chilense*
Spicules	Up to 40 μ in diameter	Up to 25 μ in diameter	Up to 26 in μ diameter
Lateral thoracic organs	Large; placed half-way along thorax	Small; placed at posterior end of thorax	Not described
Sperm duct	3 spiral turns	Unknown	6–7 spiral turns

Genus **Leptoclinides** Bjerkan, 1905

This genus was characterized by Bjerkan as having four rows of stigmata and a backwardly directed funnel-like atrial siphon. Van Name (1945) suggested that it should be no more than a subgenus of *Didemnum*, and Carlisle & Carlisle (1954) gave reasons for dividing the species hitherto assigned to *Leptoclinides* among other genera of the Didemnidae, while retaining *Leptoclinides* as a subgenus of *Didemnum*. I believe, however, that the well-developed funnel-like atrial siphon clearly distinguishes *Leptoclinides* from *Didemnum*, no species of which shows any tendency towards the production of an atrial siphon.

Leptoclinides diemenensis Michaelsen (Text-fig. 13)

Leptoclinides diemenensis Michaelsen, 1924, p. 331, fig. 12.

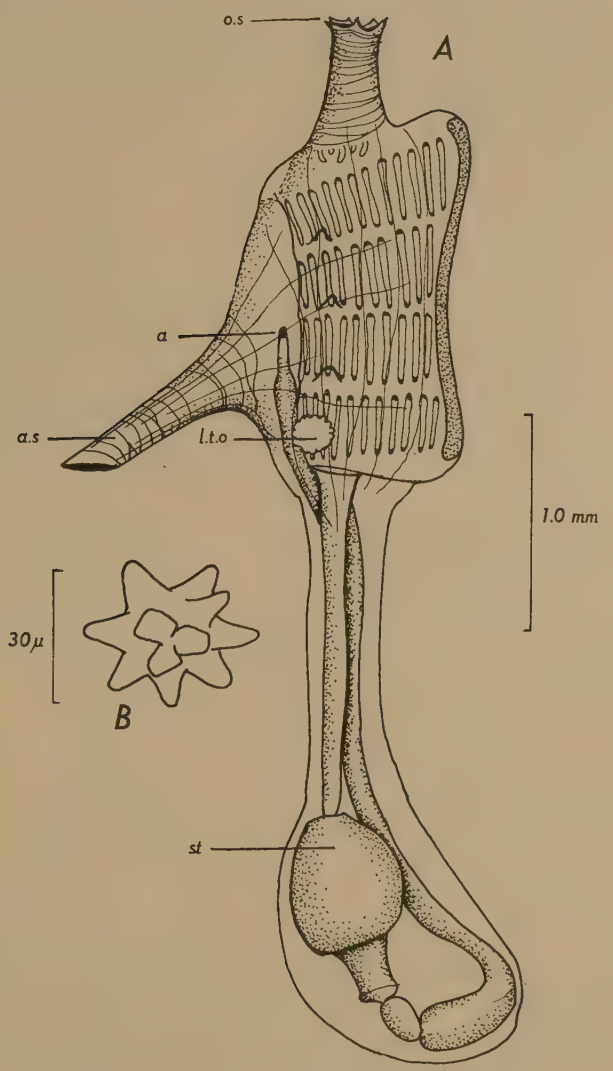
Occurrence. St. 935: North Island, New Zealand, 84 m.

Colony. The colony is about 3 cm. long and 0·7 cm. in thickness. It is pale orange brown in colour. The upper surface has a number of low rounded swellings, each with a common cloacal opening at its centre. These openings are less than 1 mm. in diameter and are spaced about 5 mm. apart. Around each opening is an irregular system of closely spaced zooids. The colony is firm and its surface smooth.

Sections show that the uppermost layer of the common test is composed largely of closely pressed bladder cells, each about 70–80 μ in diameter and extending to about five cells in depth. Below these is a layer of densely packed spicules. Spicules are also present in the deeper parts of the common test, but are more scattered. The spicules are generally 20–35 μ in diameter, only a few reaching 40 μ.

They are of a regular stellate shape, with about eight rays in optical section (Text-fig. 13 B). Small spindle-shaped and irregular cells are also present in the test, but no pigment cells.

Zooid (Text-fig. 13 A). The thorax often reaches 2 mm. in length. The abdomen, including the long waist, is about the same length, or slightly more. These zooids are larger than Michaelsen's (1924), which had a total length of 2·5 mm. In most zooids the oral siphon (*o.s.*) is quite long, tubular



Text-fig. 13. *Leptoclinides diemenensis* Michaelsen (St. 935): A, zooid; B, spicule.

to conical, and muscular, with six shallow pointed lobes. The base of the atrial siphon (*a.s.*) is at or slightly posterior to the middle of the branchial sac. The siphon varies in length in different zooids, but often is longer than the oral siphon. It is frequently, but not always, backwardly directed. Five or six slender longitudinal muscles pass along each side of the thorax. Near the posterior end of the thorax there is a conspicuous lateral thoracic organ (*l.t.o.*) on each side. The mass of spicules occupying the cavity of the organ is about 125 μ in diameter.

Branchial sac. There are twelve to fourteen long narrow stigmata in each of the four rows. The dorsal languets are short, triangular, and blunt.

Gut. This agrees well with Michaelsen's account, except that in the 'Discovery' material the anus (*a*) is rather farther forward, and lies opposite the 3rd row of stigmata instead of the 4th.

Gonads. There is no trace of gonads in any of the specimens.

Remarks. Five species of *Leptoclinides* have been described from New Zealand and Chatham Islands: *L. diemenensis* Michaelsen, *L. sparsus* Michaelsen, *L. sluiteri* Brewin, *L. marmoreus* Brewin, and *L. auranticus* Brewin. *L. sparsus* is similar to *L. diemenensis* from which it differs in having stellate pigment cells in the test. The characters which separate the remaining species are given in Table 18. Some of these characters are not very satisfactory for distinguishing the species, but as the variation within each species is not known at present, it is best to maintain them.

Table 18

	Diameter of spicules (μ)	*Length of zooids* (mm.)	*No. of stigmata per row*	*Abdomen*	*Oesophagus*	*Sperm duct*
L. diemenensis	20–35	Up to 4	12–14	Not wider than thorax	Longer than stomach	6–7 turns
L. sluiteri	12–25	Up to 1	9 or 10	Wider than thorax	Equal in length to stomach	9 or 10 turns
L. marmoreus	10–45	Up to 1·6	10	Not wider than thorax	Shorter than stomach	9 turns
L. auranticus	10–60	Up to 1	11 or 12	Equals thorax in width	Equal in length to stomach	7 turns

Sluiter (1909) has described, under the name *Polysyncraton*, a number of species from the Indonesian region evidently belonging to *Leptoclinides*. It is a little doubtful if these are all different species, and I should not be surprised if a proper revision of the group, as represented in Australasian waters, showed that the same species has been described under several names. This view is also expressed by Tokioka (1949) in dealing with *L. rufus* (Sluiter) from Japanese waters.

Distribution. North of North Island, New Zealand.

Genus Tridemnum Della Valle, 1881

Tridemnum auriculatum Michaelsen (Text-fig. 14)

Tridemnum auriculatum Michaelsen, 1919, p. 38, text-fig. 3.

Occurrence. St. WS 84: Falkland Islands, 75–74 m.

Colony. The specimen is a large sheeting colony, varying from 2 to 4 mm. in thickness, of a dirty white colour. Two or three common cloacal openings are visible on the surface. Regular stellate spicules are densely packed in all layers of the test, and range from 37 to 66 μ in diameter.

Zooid (Text-fig. 14A). The zooid agrees closely with the description given by Michaelsen (1919), except that the 'Discovery' specimen has about seven spiral turns of the sperm duct. (*s.d.*), instead of only five in the type specimen. The lateral thoracic organs are large and conspicuous, as in Michaelsen's material.

Larva (Text-fig. 14B). The larva is of the usual didemnid type, with three vertically arranged papillae (*p.*) and four pairs of anterior ampullae (*amp.*). Both ocellus and otolith are present. The larvae measure from 0·5 to 0·6 mm. in length from the end of the papillae to the base of the tail.

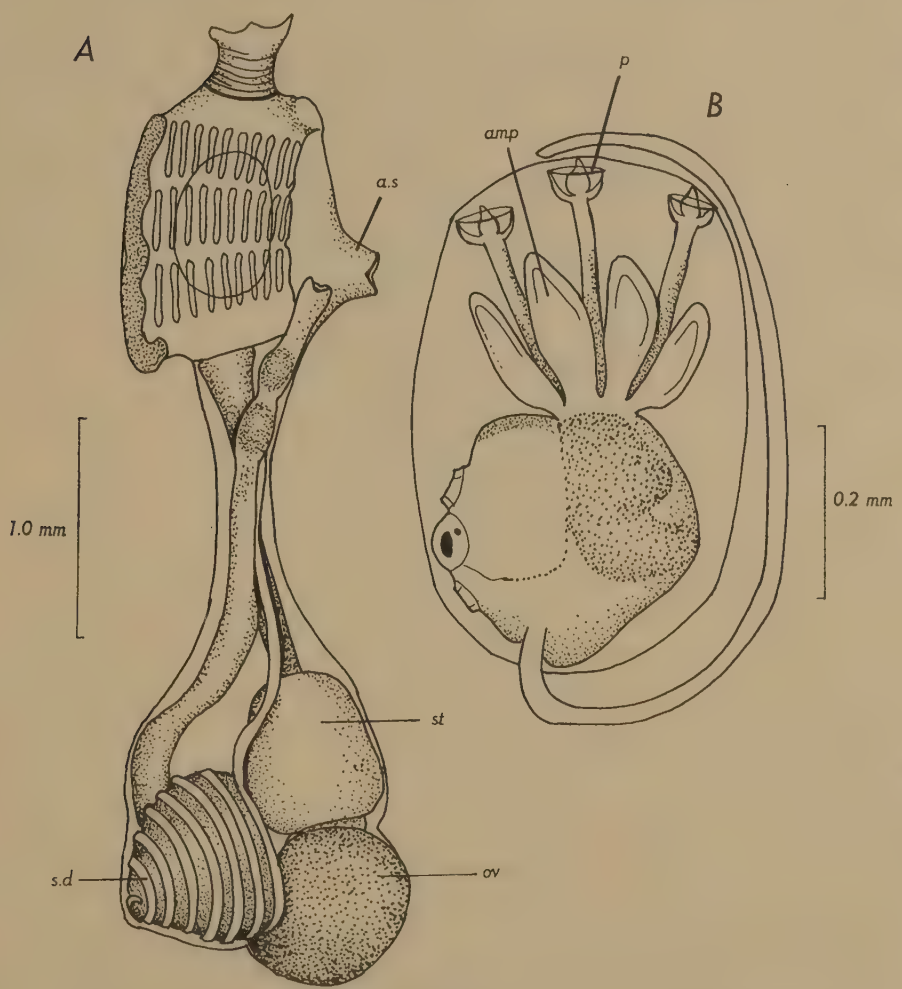
Remarks. Van Name (1945) suggested that perhaps this species was not distinct from *T. propinquum* (Herdman), but Ärnbäck (1929) stated that a comparison of the species 'shows at once that they are not identical'. The distinguishing characters particularly mentioned by Ärnbäck are given in Table 19.

These do not seem to be entirely satisfactory distinctions, and the difficulty arises from the incomplete description of *T. propinquum* given by Herdman (1886). Ärnbäck, however, was convinced that the two species are distinct, and there is no doubt that the 'Discovery' specimen belongs to *T. auriculatum*.

DISTRIBUTION. Subantarctic (Strait of Magellan; Guaitecas Islands, Chile; Falkland Islands).

Table 19

	T. propinquum	*T. auriculatum*
Zooids	Short	Long and slender
Abdomen	About same length as thorax	Twice as long as thorax
Stigmata	Short	Long and narrow



Text-fig. 14. *Trididemnum auriculatum* Michaelsen (St. WS 84): A, zooid; B, larva.

There are also in the collections several colonies of didemnid ascidians which I am unable to place, even in their correct genus, because the zooids have no gonads. It would be very unwise to try to name these specimens using other characters, because with few exceptions the nature of the testis and sperm duct is almost essential for the determination of genera and species in this family.

Family CLAVELINIDAE Forbes & Hanley, 1848

Sub-family CLAVELININAE Seeliger, 1906

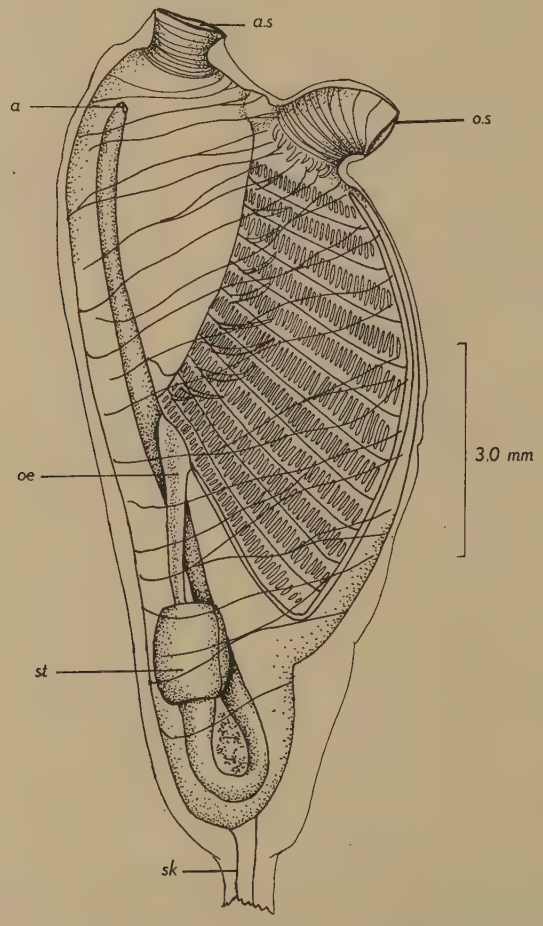
Genus Podoclavella Herdman, 1890

Podoclavella cylindrica (Quoy & Gaimard) (Text-fig. 15)

Polyclinum cylindricum Quoy & Gaimard, 1834, p. 618.
For synonymy see Michaelsen, 1930, p. 475.

OCCURRENCE. St. 1686: Victoria, Australia, 0 m.

COLONY. The colony consists of a bunch of zooids united only at their lower ends where a narrow stalk joins a stouter cylindrical stem. This is attached to the substratum by an expanded base.



Text-fig. 15. *Podoclavella cylindrica* (Quoy & Gaimard) (St. 1686): Zooid.

ZOOID (Text-fig. 15). Large zooids reach a length of 11 mm. but many of the zooids in the colony are much shorter. The body is widest anterior to the middle and tapers towards the base, where it abruptly narrows to join the stalk.

THORAX. The oral siphon (*o.s.*) does not occupy the extreme anterior end of the thorax, being instead displaced slightly down the ventral border. This siphon is also curious in being sharply bent in a ventral direction. The atrial siphon (*a.s.*) is terminal. Both siphons have numerous circular muscles. Fifteen to twenty slender muscles pass obliquely across the thorax and abdomen.

Branchial sac. In large zooids there are up to twenty-eight simple oral tentacles of alternating sizes. The very small dorsal tubercle lies transversely and has a simple slit-like opening. Eleven or twelve rows of narrow stigmata are present, the rows being separated by prominent raised bars. In large zooids there may be as many as forty-five stigmata in a row. The dorsal languets are long and slender. The branchial sac lies obliquely in the body and the rows of stigmata lie in a correspondingly oblique position.

Abdomen. The abdomen is much shorter and narrower than the thorax.

Gut. The oesophagus (*oes.*) is long and narrow, and passes straight back to the stomach (*st.*), which is ovoid and has smooth walls. Below the stomach the intestinal loop is short, but the rectum is very long and in its anterior half diverges from the dorsal side of the branchial sac. The simple anus (*a*) lies near the base of the atrial siphon.

Remarks. This species has been described under a number of generic names, but it certainly belongs to *Podoclavella* where Kott (1957) placed it, and not to *Clavelina* to which it was assigned by Michaelsen (1930).

The 'Discovery' material shows some differences from that described by Kott (1957), and is in certain respects intermediate between *P. cylindrica* and *P. australis* (Herdman). But *P. australis* is very probably a synonym of *P. cylindrica*, or at most a geographical form, as suggested by Kott. The comparison of the only marked differences that is given in Table 20 shows the intermediate position of the 'Discovery' material, and strongly suggests that only one species is involved, *P. cylindrica*.

Table 20

	P. cylindrica (Kott, 1957)	*P. australis* (Kott, 1957)	'Discovery' specimen
No. of muscles	About 25	12	15–20
No. of rows of stigmata	21	10	11 or 12

Distribution. West and south coast of Australia; Bass Strait.

Podoclavella kottae sp.n. (Text-figs. 16, 17; Pl. II, fig. 1)

Holotype. Size, largest zooid 12 cm. long. St. 934.

Diagnosis of species. Zooids united only at base. Thorax short and ovoid; abdomen stalk-like and many times larger than thorax. Atrial opening terminal; oral opening in basal half of thorax; both openings with strong wide sphincter muscles. Branchial sac with up to twenty-seven rows of stigmata, the anterior and posterior rows much shorter than the middle rows. Oesophagus and intestine very long and narrow; stomach ovoid and situated in a basal swelling of the stalk; anus close to oesophageal mouth.

Occurrence. St. 934: North Island, New Zealand, 98–92 m.

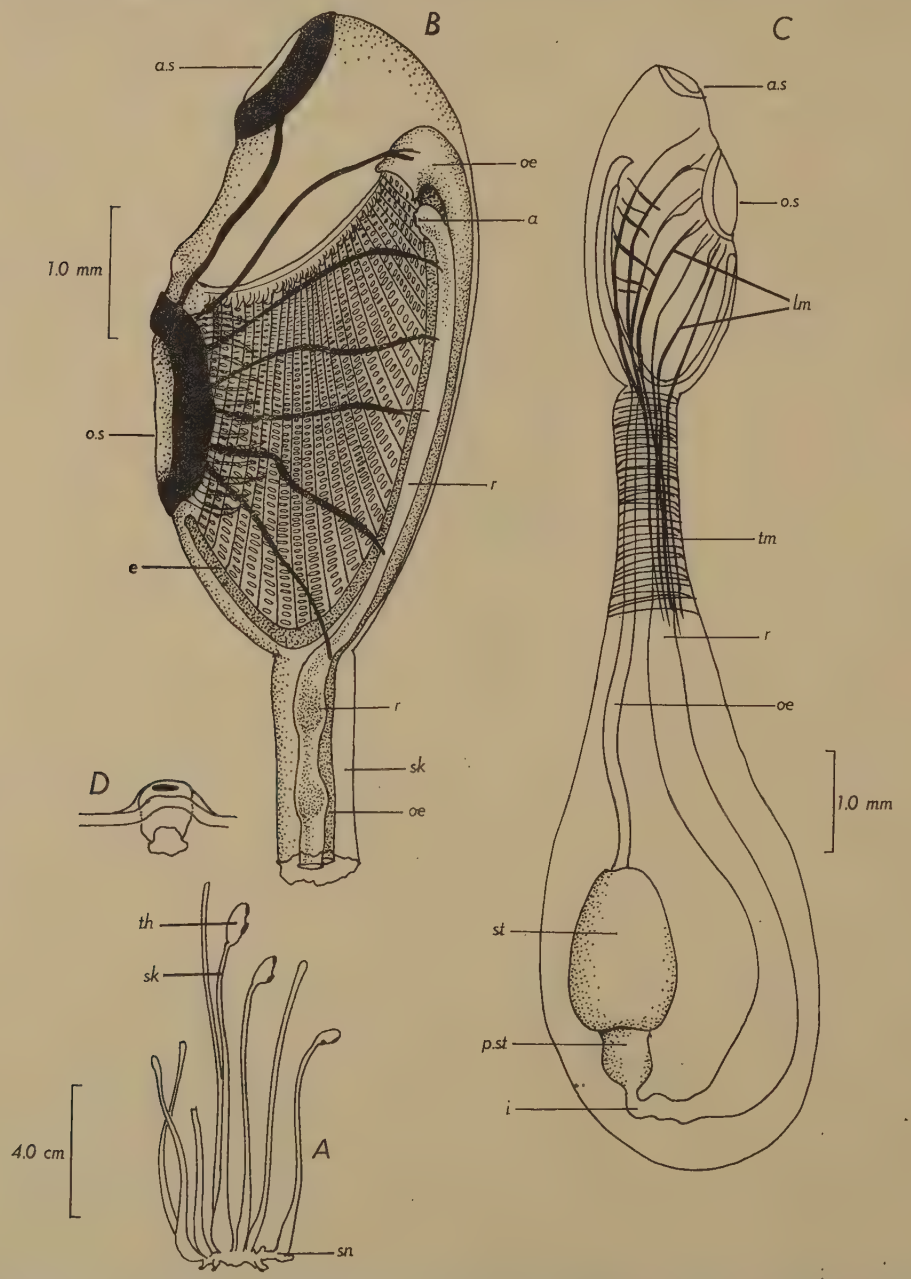
Colony (Text-fig. 16A; Pl. II, fig. 1). The specimen has eight zooids, the largest being 12 cm. long. Fully developed zooids consist of a short thorax (*th.*) borne on a long slender stalk (*sk.*) which constitutes the abdomen. The stalks have a basal swelling the lower part of which is united to a short compact creeping stolon (*sn.*). The stalks are buff-coloured and the thoraces clear.

Zooid (Text-fig. 16B, C).

Thorax. The thorax of a well-developed zooid is 5–6 mm. long and 3–4 mm. wide. It is ovoid, narrowest at its junction with the stalk and widest about one-third to one-half of its length up from the stalk. The atrial siphon (*a.s.*) is terminal or almost so, and the oral siphon (*o.s.*) slightly behind the middle of the thorax. Each opening is sessile and wide, the oral being the wider of the two. A wide and conspicuous band of circular muscle surrounds each opening. About fourteen muscles radiate

across the thorax from the margin of the oral opening, seven on each side. Anatomically these are longitudinal muscles, although in fully developed zooids they lie transversely to the longitudinal axis of the zooid. Their origin as longitudinal muscles is, however, shown by their position in young developing zooids (Text-fig. 16C, *l.m.*). A few narrow and irregular transverse strands are present on the thorax. Only the young developing stages of the zooid have transverse muscles in the abdomen (*t.m.*) and they are confined to the upper part of it.

Branchial sac. The large oral tentacles number twenty-six to twenty-eight and are arranged in a single circle. The dorsal tubercle (Text-fig. 16D) is small, with a simple transverse oval slit.

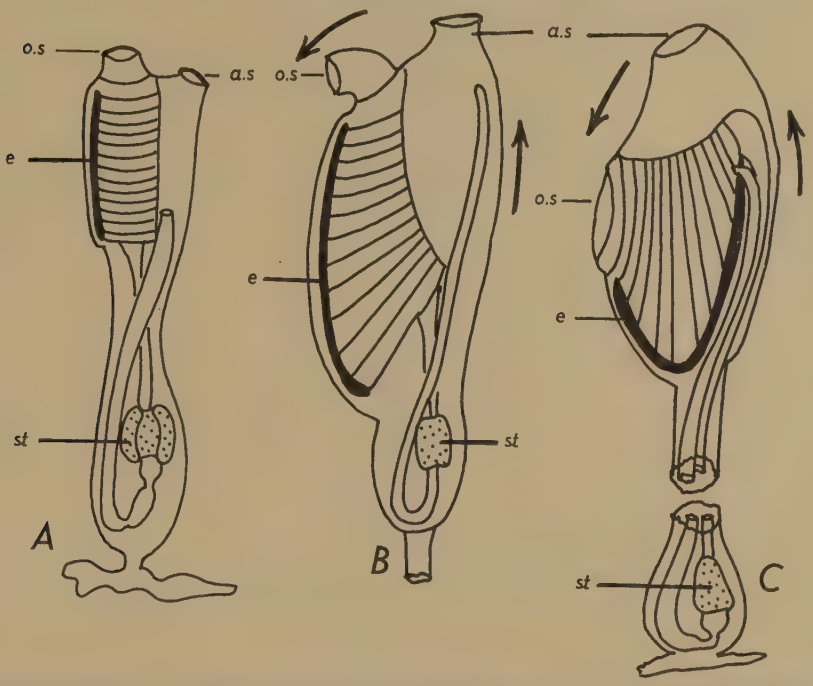


Text-fig. 16. *Podoclavella kottae* sp.n. (St. 934): A, colony; B, thorax of zooid; C, abdomen with regenerating thorax; D, dorsal tubercle.

A row of pointed triangular languets occupies the mid-dorsal line of the branchial sac. The transverse rows of stigmata number thirteen to twenty-seven, according to the size of the zooid, and the rows lie in line with the long axis of the stalk. The anterior and posterior rows are shorter than the middle ones, and the shortest rows have less than twenty stigmata, whereas at least sixty are present in the longest. The endostyle (*e*) is conspicuous and strongly curved.

Table 21

	P. detorta	*P. kottae*
Number of rows of stigmata	'Apparently 6' (van Name, 1918)	Up to 27
Lower end of intestinal loop	Some distance up from base of stalk	At base of stalk
Anus	Far anterior to oesophageal mouth; lobed (Sluiter, 1904)	Beside oesophageal mouth; without lobes



Text-fig. 17. *Podoclavella kottae* sp.n. Suggested stages in its evolution from A, the unmodified form illustrated by *Clavelina*, through B, the modified form illustrated by *Podoclavella cylindrica* to C, *P. kottae*.

Abdomen. The abdomen lies within the stalk, occupying the whole length. It is much narrower than the thorax, except at the lower end which is enlarged and accommodates the stomach and intestinal loop.

Gut. The oesophageal mouth is at the postero-dorsal corner of the branchial sac and lies within the anterior one-third of the thorax. From there the oesophagus (*oe.*) passes back behind the postero-ventral border of the branchial sac and into the stalk, within which it runs down to the basal swelling. The stomach (*st.*) is ovoid and has smooth walls. Behind it is a short conical post-stomach and a short horizontal intestine (*i*) not clearly marked off from the rectum. The rectum is wide at its lower end but narrows as it passes up within the stalk. In both stalk and thorax it lies close to the oesophagus. The anus (*a.*) is situated to the left of the oesophageal mouth and is small and simple without lobes.

Gonads. Neither ovary nor testis was present in any of the zooids.

Remarks. This species most resembles *P. detorta* Sluiter, but is distinguished as shown in Table 21.

Other characters might help to distinguish the two species, but the accounts of *P. detorta* by Sluiter (1904) and van Name (1918) differ with regard to these characters. Thus the very wide and strong sphincters on the oral and atrial openings of *P. kottae* are characteristic. According to van Name (1918) the corresponding muscles of *P. detorta* are slender, but Sluiter (1904) describes them as strong, although his figure gives no suggestion of this.

The orientation of the thorax and the great development of the abdomen in *P. detorta* and *P. kottae* are features deserving notice. The structure of *P. kottae* can be derived from the unspecialized type of *Clavelina* through a stage like that represented by *Podoclavella cylindrica*. In this series (Text-fig. 17) two processes have been involved: (1) the formation of a stalk, and (2) unequal growth of the dorsal and ventral sides of the thorax. The former process led finally to the enclosure of the abdomen within a very long narrow stalk with the consequent elongation of the oesophagus and rectum. The latter process has shifted the oral siphon down towards the stalk and at the same time drawn the oesophageal mouth up towards the still terminal atrial siphon.

Distribution. North Island, New Zealand.

Genus Clavelina Savigny, 1816

Clavelina claviformis (Herdman) (Text-fig. 18; Pl. II, fig. 2)

Colella claviformis Herdman, 1899, p. 67, pl. Dist. 3, figs. 1–15.
Clavelina sigillaria Michaelsen, 1924, p. 269, figs. 1–4.
Clavelina claviformis Kott, 1957, p. 88, fig. 22.

Occurrence. St. 929: North Island, New Zealand, 58–55 m.

Colony (Pl. II, fig. 2). Two examples are present in the 'Discovery' collections, from the same station and probably derived from the same group of colonies. One specimen is a single stalked head, and the other consists of a group of about twelve stalked heads attached to a common base. The largest of these has a head 11 cm. long on a stalk of 8 cm., and the smallest is less than half that size. In outline the head is ovate to lanceolate, and is sometimes slightly compressed, but this may be an artifact. The stalk is narrower than the head and is of uniform diameter down to the base. Both the head and the stalk are semi-transparent or pale grey, smooth and without any encrusting matter. The common test is tough and cartilaginous, but the surface has a slimy consistency. The zooids show through the test quite clearly.

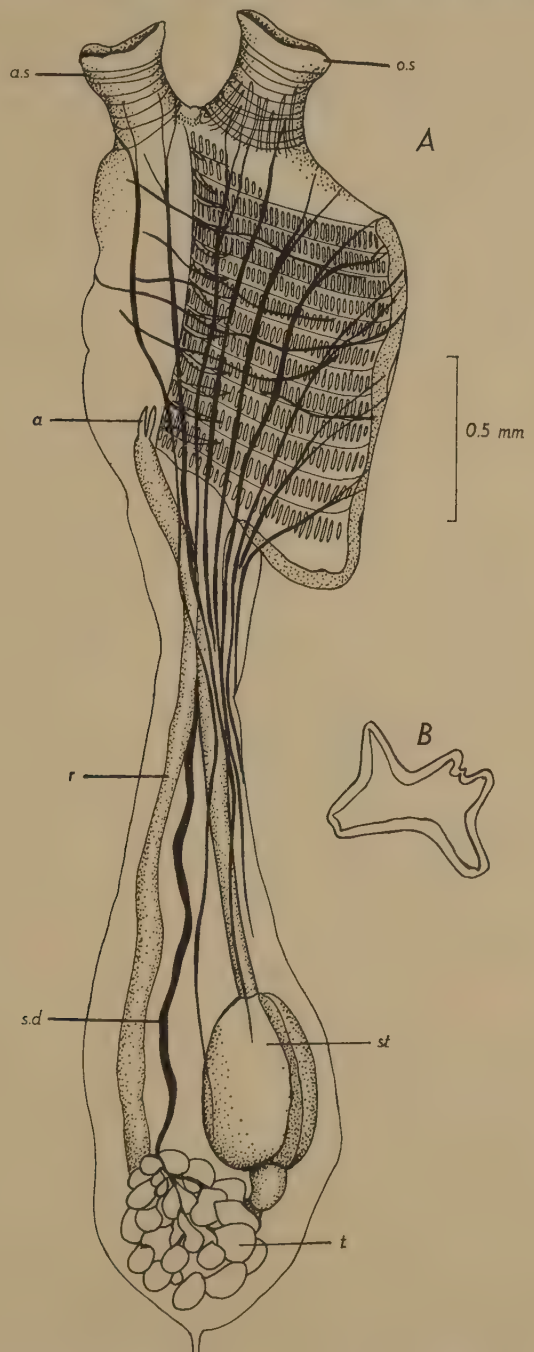
Zooid (Text-fig. 18A). The thorax is shorter and usually wider than the abdomen, especially when contracted. One typical zooid had a thorax 1·7 mm. and an abdomen 3·0 mm. long. The two siphons are of almost equal length, and are close together at the anterior end of the thorax. They have circular openings with lobes scarcely marked or entirely wanting. The body wall of the thorax has a series of nine to eleven prominent longitudinal muscles which, passing up from the abdomen, diverge as they approach the anterior part of the thorax, where they generally divide into a few branches. The more ventral muscles of the series diverge towards the ventral margin of the thorax, recalling the course of the muscles in *Tylobranchion*.

Branchial sac. From twelve to twenty long slender simple oral tentacles are present in a single circle. The dorsal tubercle is small, with a narrow transverse oval slit. In some zooids the branchial sac has nine rows of stigmata, but more often there are ten to twelve complete rows and two or three short anterior rows, each consisting of a few stigmata in the dorsal part of the branchial sac and none in the ventral part. There are up to forty-five stigmata in the complete rows. The dorsal languets are pointed and moderately long, those at the posterior end being the longest.

Gut. The long narrow oesophagus passes down to the stomach which lies in the posterior third

of the abdomen. The stomach (*st.*) is ovoid or in some zooids nearly globular. There are four folds on the walls, best seen in a transverse section (Text-fig. 18B). The intestine is short and the rectum (*r*) long and narrow. The anus (*a*) lies far back in the thorax, opposite the last or second last row of stigmata; it has two deep rounded lobes.

GONADS. Some of the zooids have a well-developed testis (*t.*) consisting of a large group of many small pear-shaped follicles, lying on the right side of the zooid near the lower part of the intestinal



Text-fig. 18. *Clavelina claviformis* (Herdman) (St. 929): A, zooid; B, transverse section of stomach.

loop. The sperm duct passes almost straight forward beside the rectum. No ovary was found in any zooid examined, but the zooids are known to be hermaphrodite.

DISTRIBUTION. Eastern Australia; North Island, New Zealand.

Subfamily POLYCITORINAE Michaelsen, 1904

Berrill (1950) proposed the subfamily Holozoinae for the three genera, *Distaplia* Della Valle, 1881, *Holozoa* Lesson, 1830, and *Sycozoa* Lesson, 1830, and pointed out that these genera formed a very natural group of closely related forms. Many authors have had difficulty in deciding whether these three genera are in fact separate. Thus Hartmeyer (1909, in Bronn) regarded *Distaplia* as a synonym of *Holozoa*, but maintained *Sycozoa*. Van Name (1945) allowed the separation of *Holozoa* mainly on the grounds of the shape of the colony and the alleged pelagic phase in its adult life, but was evidently not entirely satisfied that it is distinct from *Distaplia*. Brewin (1953) united the two genera under the *nomen conservandum Distaplia*, at the same time maintaining the separation of *Sycozoa*, and establishing a new genus *Hypsistozoa*. I agree with Brewin's decision to unite *Holozoa* and *Distaplia*, but the position of *Sycozoa* is more difficult to determine.

Before Brewin's (1953) paper, the colony of *Sycozoa* had been described as typically having one terminal common cloacal opening, but she found in living material from New Zealand waters a 'very regular arrangement of the common cloacal apertures around the periphery of the distal part of the head, a region entirely free of zooids...'. As I shall show below, this is certainly not the case in the 'Discovery' specimens, in which examination of many well-preserved colonies, both of *S. sigillinoides* and *S. georgiana*, showed one terminal common cloacal opening. Brewin emended the generic description to agree with her New Zealand material, and acceptance of the emended diagnosis would exclude both the type species *S. sigillinoides* and also *S. georgiana*. This seems to be unjustified, and I suggest that the arrangement of the common cloacal openings be disregarded.

The question is further complicated by the structure of a new species, *Sycozoa anomala*, in the 'Discovery' collections, from north of New Zealand. The main reason for separating *Sycozoa* from *Distaplia* has hitherto been the unisexual nature of the colonies of *Sycozoa* and their hermaphrodite nature in *Distaplia*. But the new species, *S. anomala*, from the 'Discovery' collections, which in all other respects agrees well with other species of *Sycozoa*, has hermaphrodite colonies as well as unisexual ones. The distinction between the two genera thus seems to break down. In *S. anomala* the position of the ovary also is somewhat intermediate between the genera, and the logical course might be to unite *Sycozoa* with *Distaplia*, the name *Sycozoa* having priority. But as there are many well-known species bearing the name *Distaplia*, this course would undoubtedly lead to great confusion, and I have retained both *Distaplia* and *Sycozoa*.

Genus Sycozoa Lesson, 1830

There are several reasons why separation of species of *Sycozoa* is difficult, one of the more important being ignorance of the changing forms of the colony during its normal annual cycle, and under different conditions of environment. Thus *S. ramulosa* (Herdman) and *S. umbellata* (Michaelsen) may be two forms of *S. sigillinoides*. The characters of *S. ramulosa* which Ärnbäck (1950) used to distinguish it from *S. sigillinoides* are: (1) its longer body and especially the branchial sac; (2) the extension of the testis beyond the intestinal loop; (3) the small number (one to three) of eggs in each brood pouch.

The shape of the body depends greatly on its state of contraction and is rather a difficult character to determine. The size of the testis varies according to the degree of sexual development of the zooid and is therefore also unreliable. It may be noted that, among the 'Discovery' material, there are colonies combining character (2) of *S. ramulosa* with character (3) of *S. sigillinoides* (e.g. St. 1230). Moreover,

Michaelsen (1924) found brood pouches in *S. sigillinoides* containing from one to three larvae, and I have found from two to fourteen in different specimens of the same species. I therefore agree with van Name (1945) and Kott (1954) that *S. ramulosa* is a synonym of *S. sigillinoides*.

Regarding *S. umbellata* (Michaelsen) both Michaelsen (1924) himself and Ärnbäck (1950) are inclined to regard this also as a synonym of *S. sigillinoides*.

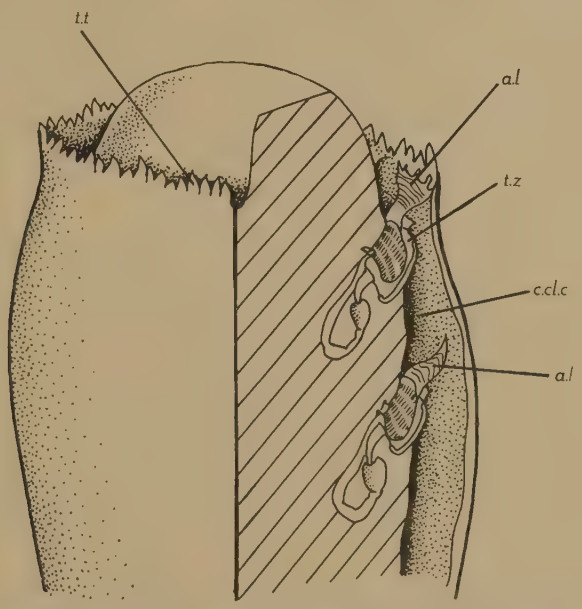
S. georgiana (Michaelsen) is another form which some authors think might be *S. sigillinoides* (Brewin, 1953). But I believe that the speciess hould be maintained (see p. 74), although I am not altogether sure that it is distinct from *S. gaimardi* (Herdman), an insufficiently known form.

Herdman (1886) described *S. quoyi* from Kerguelen, but his description did not sufficiently distinguish it from *S. sigillinoides*. Kott (1954) maintains their separation on the grounds of slight anatomical distinctions in the gut and the much larger size of the larva. In view of the variations in larval size which can occur within one species I am still doubtful about the validity of *S. quoyi*.

Sycozoa sigillinoides Lesson (Text-fig. 19, Pl. II, figs. 3–8)

Sycozoa sigillinoides Lesson, 1830, p. 436, pl. Moll. 13, fig. 15, 15b.
Non *Sycozoa sigillinoides* Brewin, 1952, p. 190, text-fig. 2.
For synonymy see van Name, 1945.

Occurrence. St. 45: S. Georgia, 238–270 m. St. 51: Falkland Islands, 105–115 m. St. 53: Falkland Islands, 0–2 m. St. 145: S. Georgia, 26–35 m. St. 652: Burdwood Bank, 164 m. St. 1230: Magellan Strait, 27 m. St. WS 84: Falkland Islands, 75–74 m. St. WS 85: Falkland Islands, 79 m.



Text-fig. 19. *Sycozoa sigillinoides* Lesson. Cut-away section of the upper part of the head.

St. WS 90: Patagonian Shelf, 82–81 m. St. WS 92: Patagonian Shelf, 145–143 m. St. WS 95: Patagonian Shelf, 109–108 m. St. WS 214: Patagonian Shelf, 208–219 m. St. WS 215: Patagonian Shelf, 219–146 m. St. WS 220: Patagonian Shelf, 108–104 m. St. WS 226: Patagonian Shelf, 144–152 m. St. WS 237: Patagonian Shelf, 150–256 m. St. WS 239: Patagonian Shelf, 196–193 m. St. WS 243: Patagonian Shelf, 144–141 m. St. WS 244: Patagonian Shelf, 253–247 m. St. WS 245: Patagonian Shelf, 304–290 m. St. WS 765: Patagonian Shelf, 113–119 m. St. WS 772: Patagonian Shelf, 309–163 m. St. WS 775: Patagonian Shelf, 115–110 m. St. WS 784: Patagonian Shelf, 170–

164 m. St. WS 785: Patagonian Shelf, 150–147 m. St. WS 799: Patagonian Shelf, 0 m. St. WS 800: Patagonian Shelf, 137–139 m. St. WS 814: Patagonian Shelf, 112–119 m. St. WS 816: Patagonian Shelf, 150 m. St. WS 818: Patagonian Shelf, 272–278 m. St. WS 819: Patagonian Shelf, 313–329 m. St. WS 833: Patagonian Shelf, 38–31 m. St. WS 834: Patagonian Shelf, 27–38 m. St. WS 839: Patagonian Shelf, 503–534 m. St. WS 841: Patagonian Shelf, 110–121 m. St. WS 847: Patagonian Shelf, 51–57 m.

Colony. The shape of the colony varies greatly but the causes of variation are only partly known. In many specimens which are fully developed and more or less intact there is a stout main stem which in life appears to have lain on the sandy bottom either free or loosely fixed. This stem fulfils the function of a creeping stolon and gives rise to one or a few bunches of upright stalks, each stalk bearing a single head (Pl. II, figs. 3, 4). A true rooting system does not seem to be developed, but in other respects the habit is very like that of the Australian species *S. tenuicaulis* (Herdman) (see Herdman, 1899, pl. Dist. 1, fig. 2; Brewin, 1953. Text-fig. 1B).

Many specimens, however, have a single stalk bearing one head (e.g. St. WS 90); these are perhaps broken pieces of complex colonies, for they have the same characters of stalk and head.

A third type of colony consists of a simple or slightly branched stalk attached basally to a solid object (e.g. St. WS 95).

Many unattached heads were also taken in the collections, and these will be referred to later (see p. 73).

Finally there is the headless condition represented either by isolated hard orange-coloured stalks or by whole complex colonies completely lacking zooids (e.g. St. WS 800) (Pl. II, fig. 5).

In well-developed complex colonies the stalks reach 6 cm. in length, occasionally more, and the heads up to 2·5 cm. long and 1·0 cm. wide.

Two groups of specimens from South Georgia (St. 45, St. 145) have a short fleshy stalk attached to an alga, and a head at least twice as long as the stalk (Pl. II, fig. 8). As the structure of the head, the zooids and their arrangement, and the larvae all agree closely with the other examples of *S. sigillinoides* in the collection, I am including these specimens within that species, although not entirely satisfied with this course. They are very like the specimens also from South Georgia figured by Ärnbäck (1950, fig. 26) as *S. sigillinoides*, and like Herdman's (1886) type of his species *S. quoyi* from Kerguelen, and also like Michaelsen's (1907) specimens from South Georgia, which he named *S. quoyi* var. *zschaui*. I regard *S. quoyi* as a synonym of *S. sigillinoides*.

In the 'Discovery' colonies, which are preserved in alcohol, the head is soft and usually yellow-grey. It is almost cylindrical, and rounded or tapered at each end. The stalk, although wide at the upper end, is sometimes constricted where it joins the head, and is narrowest at the base. It is firm, buff or dull orange in colour, and typically marked with fine annular ridges. The basal stem is similar to the stalk but is stouter and usually shorter.

As I have already remarked, I disagree with Brewin (1953) in her description of the common cloacal openings in the genus. In well-preserved specimens of *S. sigillinoides* which I have examined, the apex of the head has a single common cloacal opening, all the more clearly marked because the test bears a series of teeth round its border (Text-fig. 19, *t.t.*). The opening is ring-shaped as viewed from the apex of the colony owing to the projection of the central core of common test of the head. The individual cloacal canals, each serving a double row of zooids, lead into the terminal opening, and not directly to the surface of the colony.

Zooid. The atrial languet has been described as 'of varying length' (van Name, 1945), and 'sometimes fringed with a number of lobes' (Kott, 1954). I have found that differences in the atrial languet are related to the position of the zooid in the colony. All zooids except the terminal one in each row

have a pointed triangular languet. In the terminal zooids only, that is those immediately round the common cloacal opening, the end of the atrial languet is wide and straight with a row of pointed or leaf-like teeth. These teeth correspond to the teeth present on the test round the common cloacal opening, already mentioned, and doubtless are responsible for their formation.

The intestine only occasionally shows the subdivisions which Kott (1954) used to distinguish *S. sigillinoides* from *S. quoyi*.

Larva. The larvae from different colonies vary in size from 0·40 to 0·76 mm., measured from the end of the papillae to the base of the tail, the majority being between 0·50 and 0·60 mm. Caullery (1909), Salfi (1925) and Kott (1954) have already described the larva. The sensory vesicle contains only one black pigment spot, the spherical otolith, 22–26 μ in diameter.

Biology. Breeding probably does not occur in the southern winter, yet as shown by the figures in Table 22 it is not restricted to a short period of the year.

Table 22

Month	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
No. of colonies examined	3	3	6	—	—	5	1	6	4	6	9	3
No. of colonies with embryos	1	1	0	—	—	2	0	1	1	2	4	1

In different colonies the embryos in the brood pouches numbered from two to fourteen.

The heads and zooids are unisexual, but all zooids in a head are not at the same stage of development. In a single head buds and young non-functional zooids may be found at the base; then a zone of functional but sexually unripe zooids occurs; and finally the distal part of the head is devoid of zooids but contains many isolated brood pouches with embryos and larvae. The brood pouches disappear finally, having presumably been set free by the disintegration of the common test. Whether the larvae escape before or after this is unknown.

It has long been known that heads occur free in the water, and indeed the first record of the species (Lesson, 1830) was of an isolated pelagic head. Free heads were frequent amongst the 'Discovery' material, having been taken in various years in January, February, October and December, i.e. in the southern spring and summer. Brewin (1953) suggests that the breaking off of heads is caused by rough weather, but van Name (1945) considers it as probably a normal event in the life of the species. Headless stalks, at any rate, seem to be a part of the annual cycle (Pl. II, fig. 5); they occur in the 'Discovery' collections sometimes in December, but most often in May, June and July, i.e. in the southern winter. At the depths from which these headless stalks were collected (137–304 m.) storm action could not account for the loss of the heads, and I conclude that they were lost in the normal course of events. But headless stalks do not necessarily imply free pelagic heads, as heads disintegrate after breeding. Whether intact heads also break off, except by storm or other accidental damage, is still doubtful.

The headless stalks do not die, and Pl. II, fig. 7, illustrates the growth of new heads. The old stalk consists of a firm outer layer with a sharply defined upper margin, and a softer central core of test material containing many small rounded orange bodies and perhaps a few remaining vascular processes from the zooids which formerly occupied the head. Caullery (1909) and Salfi (1925, 1926) have shown that these rounded bodies are buds formed by multiple constriction of the vascular processes of the zooids. The reduced state of the colonies, containing the buds but no zooids, recalls the overwintering condition of colonies of the Family Polyclinidae, but I do not know if the colony of *Sycozoa* also has a period of quiescence. When the buds develop they produce new zooids within the central test near the upper end of the old stalk, and at the same time new central test material begins to bulge out from the end of the stalk. As the new test continues to grow it forms a new head containing the

developing zooids. Regenerating heads on old stalks were taken in December, March and May, but most often in June and July. We may conclude that loss of the head follows breeding and is in turn followed by regeneration of a new head, the speed of regeneration perhaps depending on water temperature, as in colonies of *Aplidium* in northern temperate waters.

In the related genus *Hypsistozoa*, Brewin (1956*a*) has shown that, accompanying and following the production of larvae, the distal part of the head of the colony is resorbed. Meanwhile, new zooids at the junction of the stalk and the old head are forming a new head. This is a process very similar to that occurring in *Sycozoa*.

It seems curious that one species should show two habits so different as the single stalk and the branched complex form. Perhaps some of the apparently simple forms are stalks broken off from more complex colonies, but it is also possible that the simple and the complex forms represent different phases of the life cycle. This is suggested by the growth of several young heads instead of one, from the end of the old stalks, a process seen in several specimens (Pl. II, fig. 7). Perhaps the colonies which develop from settled larvae have single stalks, which, after breeding and loss of the head, may develop a group of new heads from the original stalk, thus giving rise to a complex colony, the original stalk becoming the stout basal stem of the new colony.

Distribution. Owing to the confusion regarding species it is difficult to state exactly the distribution of *S. sigillinoides*, but it is certainly widely spread in both western and eastern parts of southern and Subantarctic waters (Falkland Islands, Patagonian Shelf, Tierra del Fuego, Kerguelen, Macquarie Island, Tasmania, South Australia) and the Antarctic (South Georgia, Graham Land, Kaiser Wilhelm II Land, Enderby Land, MacRobertson Land).

Sycozoa georgiana (Michaelsen) (Pl. III, fig. 5)

Colella georgiana Michaelsen, 1907, p. 62, pl. 1, fig. 6; pl. 3, fig. 15.
For synonymy see van Name, 1945, pp. 154–5.

Occurrence. St. 39: S. Georgia, 179–235 m. St. 140: S. Georgia, 122–136 m. St. 149: S. Georgia, 200–234 m. ?St. 363: S. Sandwich Islands, 329–278 m. ?St. WS 33: S. Georgia, 130 m. St. MS 14: S. Georgia, 190–110 m. St. MS 68: S. Georgia, 220–247 m.

Colony (Pl. III, fig. 5). The form of the colony and the shape of the head are the main features which distinguish this species from *S. sigillinoides*. Colonies are attached to some solid object over which spreads a system of creeping branched stolons giving rise at intervals to single or grouped stalks. Each stalk bears a characteristic head which is pear-shaped or almost globular, and never, in the specimens examined, long as in *S. sigillinoides*. The heads in the 'Discovery' material are not laterally compressed as in Michaelsen's (1907) description. Usually the head is as wide as long, and sometimes is wider. One of the largest specimens has a stalk of 4·7 cm. and a head 0·7 cm. long by 0·9 cm. wide. The stalk and the head are of the same pale grey colour and the same smooth rather soft consistency, whereas in *S. sigillinoides* the head and stalk differ from each other. Zooids are generally absent from the lower part of the head, and the oral openings are confined to a wide zone round the single terminal common cloacal opening. Sluiter (1932) found that the zooids were not arranged in rows, and Michaelsen (1907) did not mention any regular arrangement. At first sight this also seems to be the case in the 'Discovery' specimens, but careful examination shows that the zooids are in short rows each with a few zooids.

Zooid. The zooid seems to present no characters by which it can be distinguished from *S. sigillinoides*. Certainly it cannot be separated by the number of branchial stigmata in a row, as Kott (1954, p. 155) has done in her key. Sluiter (1932) stated that in *young zooids* the stigmata number ten to twelve in each half row, but in fully developed zooids there are up to twenty, and in the 'Discovery'

material I have counted eighteen stigmata in a half row. This is the same number as in many zooids of *S. sigillinoides*. As in *S. sigillinoides* the zooids immediately surrounding the common cloacal opening have a broad-ended atrial languet, but in other zooids it is pointed. The brood pouches are long, narrow and coiled at the lower end.

Larva. Embryos and larvae together numbering from ten to twenty-eight in a brood pouch are present in some colonies collected in March. The larvae measure from 0·60 to 0·65 mm. from the end of the papillae to base of the tail, and could not be distinguished from larvae of *S. sigillinoides*, unless by a somewhat longer tail, but this is a variable character.

Remarks. In spite of its resemblance to *S. sigillinoides*, I do not doubt that *S. georgiana* is a valid species. Its known range is confined to South Georgia and perhaps the South Sandwich Islands (St. 363). It is not a form that has often occurred in any collections, and owing to its scarcity, little is known of its biology.

One colony from South Georgia (St. WS 33) has a shape very like that described for *S. gaimardi* (Herdman, 1886). But as no characters other than the mushroom-shaped head and the large number of embryos in the brood pouch seem reliable in that species, and the 'Discovery' colony is without embryos, I have included the specimen in *S. georgiana*.

Distribution. Antarctic (South Georgia, ?South Sandwich Islands).

Sycozoa anomala sp.n. (Text-fig. 20; Pl. III, fig. 6)

Holotype. Size: head 1·8 cm., stalk 2·0 cm. long. St. 929.

Diagnosis of species. Colonies hermaphrodite or unisexual. Zooids unisexual; female with coiled brood pouch; branchial sac with no parastigmatic transverse bars; stomach smooth externally; ovary somewhat projecting below the abdomen. Larva with otolith but no ocellus.

Occurrence. St. 929: North Island, New Zealand, 55–58 m.

Colony (Pl. III, fig. 6). The material consists of three single colonies and a compound colony with four stalked heads. The largest of the single heads has a length of 1·8 cm. and a breadth of 1·3 cm., and is carried on a stalk of 2·0 cm. The compound colony has a basal stem of 1·3 cm. at the end of which is a group of four stalks, the longest 1·3 cm. The heads of the isolated colonies are a little flattened but the compound colony has round heads. The head is smooth and pale translucent buff-grey, the zooids being visible as double rows of paler spots. Longitudinal furrows separate the adjacent double rows. The stalk is rather paler than the head, widest at its attachment to the head, and tapering towards the base. The compound colony has a certain amount of sand sticking to the basal stem, but the other colonies are quite free of sand. At the apex of each head there is a single simple common cloacal opening, through the centre of which the terminal common test may project slightly.

Zooid (Text-fig. 20 A). The zooid is about 2 mm. in length, seldom more, and the thorax and abdomen are of about equal length, except when the gonads are highly developed and projecting. The oral siphon (*o.s.*) has six short pointed lobes and the atrial opening is large with a triangular atrial languet (*a.l.*). The zooids surrounding the common cloacal opening have a wide languet with a few small teeth; the remaining zooids have a narrower triangular languet without teeth.

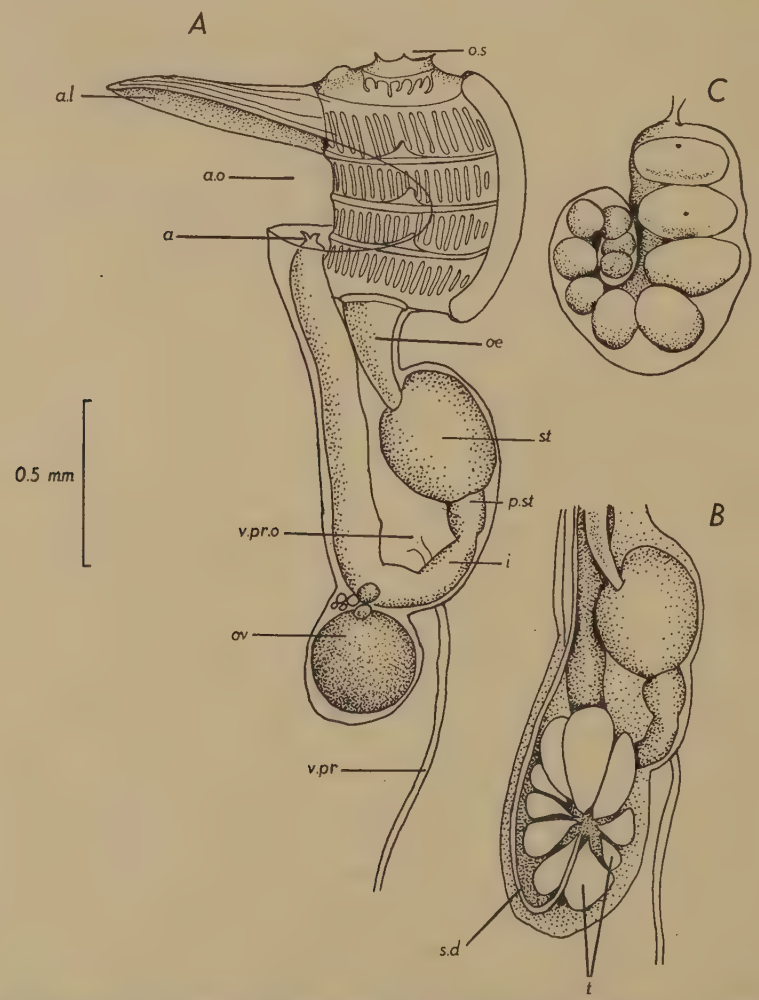
Branchial sac. There are about sixteen long slender oral tentacles of varying length. The four rows of stigmata have no parastigmatic transverse bars. A short blunt languet is present on each transverse bar of the left side. The stigmata are long and narrow, and number at least fifteen in each row. The endostyle is wide.

Gut. The oesophagus (*oe.*) is of moderate length, narrow and curved ventrally. The ovoid or pear-shaped stomach (*st.*) has walls which are smooth externally, but internally are provided with minute papillae. White pigment spots are scattered on the surface of the stomach. A short post-stomach (*p.st.*)

leads to the intestine (*i*) which forms a short loop. The rectum is straight and ends with a two-lipped anus lying level with the transverse bar separating the third and fourth rows of stigmata.

Vascular process. A slender vascular process (*v.pr.*) arises from the left side of the abdomen and passes down below the zooid into the common test of the colony. Some of these processes, but not all, extend down into the stalk of the colony.

Gonads. In the compound colony all the zooids were male, but two of the single colonies had both male and female zooids; the third single colony was in degeneration.



Text-fig. 20. *Sycozoa anomala* sp.n. (St. 929): A, female zooid; B, abdomen of male zooid; C, brood pouch with embryos.

The ovary (*ov.*) lies slightly behind the intestinal loop, but in contact with it, and bulges out from the abdomen to form a small sac-like projection recalling the condition in *Distaplia*. The ovaries examined contained a group of ova of various sizes.

In male zooids the testis (*t*) is a rosette of six to ten wedge-shaped follicles contained in a projection from the abdomen similar to that accommodating the ovary in female zooids, but generally larger. The sperm duct (*s.d.*), arising from the centre of the rosette, loops back before passing forward beside the rectum (Text-fig. 20B).

Many of the female zooids had well-developed brood pouches (Text-fig. 20C). These are rather short, strongly coiled, and usually contained from nine to eleven embryos.

None of the zooids showed any sign of hermaphroditism, and the youngest buds in which any gonad was visible were clearly either male or female.

Larva. The larva could not be distinguished from that of *S. sigillinoides* except by its rather smaller size, 0·44–0·48 mm. from the end of the papillae to the base of the tail. This size, however, falls within the range of the larva of *S. sigillinoides*.

Remarks. In most respects this species is a quite typical *Sycozoa*, but the hermaphrodite nature of the colonies is exceptional.

The species seems to come closest to *S. pulchra* (Herdman) from the Torres Strait between Australia and New Guinea, and *S. kanzasi* (Oka) from Japanese waters. *S. pulchra* has hermaphrodite zooids and is therefore clearly different. *S. kanzasi* is more difficult to distinguish, but the species can be separated as shown in Table 23.

Table 23

	S. kanzasi	*S. anomala*
Oral siphon	Usually with plain margin	With 6 short pointed lobes
Oral tentacles	12	16
Knob-like structure over stomach	Present	Absent
Anus	With plain margin	With 2 lips

There is little doubt that the two species are very nearly related. Unfortunately the gonads of the specimens seen by Oka (1930) and Tokioka (1953) were not well developed. The knob-like process over the stomach is perhaps an unsatisfactory character for separating the species, because it is interpreted by Tokioka as a rudimentary bud and is therefore liable to be present or absent according to the phase of asexual development at which the zooid is examined.

Distribution. North end of North Island, New Zealand.

Genus Distaplia Della Valle, 1881

Distaplia colligans Sluiter (Text-fig. 21; Pl. III, fig. 3)

Distaplia colligans Sluiter, 1932, p. 7, figs. 5–8.

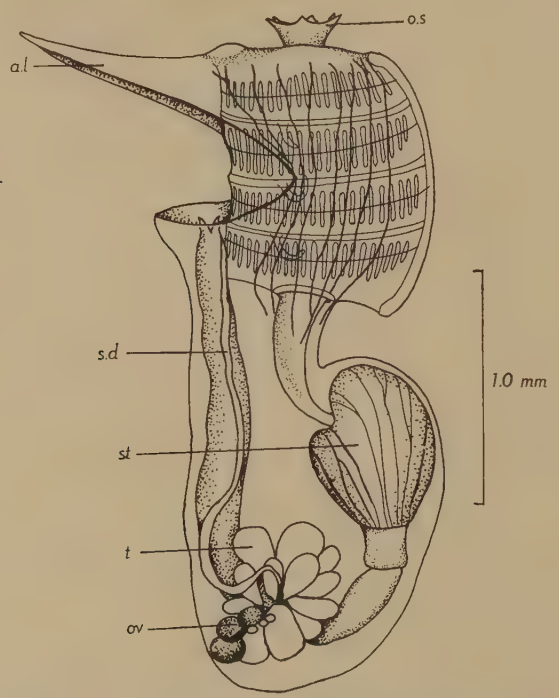
Occurrence. St. 164: S. Orkneys, 24–36 m. St. 476: S. Georgia, 165–0 m. St. 1113: Bransfield Strait, 275–130 m. St. MS 63: S. Georgia, 23 m. St. MS 74: S. Georgia, 22–40 m.

Colony. The colonies from stations 164, MS 63 and MS 74 are all very similar. The largest of these specimens is 1·2 cm. long and 0·3 cm. thick (St. MS 63). The preserved colour is a dull purple brown, marked with paler spots where the zooids show through the test. Generally the colonies are rather low and flattened or pillow shaped, not subdivided or lobed. No common cloacal openings are apparent on the surface, and usually no regular arrangement of the zooids can be made out, although in parts of one of the colonies from St. MS 63 there is an appearance of linear arrangement. In one of Sluiter's specimens there was a regular alignment of the zooids in double rows, but in the other this was apparently not conspicuous. The common test is soft and pliable, and semi-transparent but with a slightly cloudy appearance owing to the presence of many small pale cells, especially in the surface layer.

Zooid (Text-fig. 21). The zooids generally measure about 3 mm. in length, but their length in life was probably rather more, as the thorax in most colonies is much contracted, except in the specimens from St. 476 and St. 1113, which will be discussed later (p. 78). The oral siphon (*o.s.*) is short, sometimes quite distinctly six-lobed, but more often almost without lobes. Narrow but fairly strong thoracic muscles are present. A triangular and moderately long atrial languet (*a.l.*) is found in all zooids. I could find no trace of a vascular process from the posterior end of the zooids.

Gut. The oesophagus is narrow and of moderate length. In some colonies the wall of the stomach (*st.*) is distinctly marked with many fine ridges, but in others the wall is almost smooth externally. Sluiter does not describe any markings on the stomach of his type specimens, and his figure shows none.

Gonads. The gonads in Sluiter's specimens were evidently not very well developed, only a group of small testis follicles being present, and no trace of an ovary. Sluiter concluded that the colonies were unisexual. 'Discovery' specimens collected in February and March show a variety of sexual stages. In one colony some zooids are seen with a group of about twelve testis follicles (*t*) and a few small ova (*ov.*), and other zooids have a testis and quite large ova. The colony from the South Orkney



Text-fig. 21. *Distaplia colligans* Sluiter (St. MS 63): Zooid.

Islands has zooids with only the ovary present and no testis. It is likely that Sluiter's two specimens were in the early male phase. The gonads are situated beside the loop of the intestine and scarcely project from the body except when at the height of their development. Only in some colonies from South Georgia and the South Orkney Islands is there any sign of a brood pouch; the zooids have a small sac-like projection from the dorsal body wall behind the atrial opening, evidently in the early stages of development.

Remarks. All these colonies, with the possible exception of the ones from St. 476 and St. 1113, are in good agreement with Sluiter's type specimens of *D. colligans*, although the new specimens differ slightly in having markings on the wall of the stomach, and in the larger size of the zooids.

The single colonies from St. 476 and St. 1113 (Pl. III, fig. 3) are larger (2 cm. in diameter and 7 cm. long respectively) and paler than those already described. The zooids also are much larger, reaching 8 mm. in length when fully expanded. In other respects, however, they are similar and I am inclined to think that the differences may be due to the stage of the annual cycle at which the colonies have arrived.

D. colligans must be considered rather scarce or at least hard to find, and it may prove to have a wider distribution in the Antarctic than at present appears.

DISTRIBUTION. Antarctic (South Georgia; South Orkney Islands; Bransfield Strait).

Distaplia cylindrica (Lesson) (Pl. III, fig. 4)

Holozoa cylindrica Lesson, 1830, p. 439.
For synonymy see van Name (1945), p. 143.

OCCURRENCE. St. 39: S. Georgia, 179–235 m. St. 45: S. Georgia, 238–270 m. St. 123: S. Georgia, 230–250 m. St. 140: S. Georgia, 122–136 m. St. 142: S. Georgia, 88–273 m. St. 148: S. Georgia, 132–148 m. St. 149: S. Georgia, 200–234 m. St. 189: Palmer Archipelago, 0 m. St. 366: S. Sandwich Islands, 155–322 m. St. 1900: Patagonian Shelf, 0–5 m. St. 1906: Patagonian Shelf, 0–5 m. St. WS 33: S. Georgia, 0–5 m. St. WS 90: Patagonian Shelf, 82–81 m. St. WS 765: Patagonian Shelf, 113–119 m. St. WS 787: Patagonian Shelf, 106–110 m. St. MS 68: S. Georgia, 220–247 m. B.G.L.E., Stella Creek. B.G.L.E., Port Lockroy, 0–5 m.

COLONY. Many of the specimens in the collection are only parts of colonies, but there are also a few intact specimens, in which the base is attached, generally to a few small stones or pebbles. This basal area is sometimes wider than the rest of the colony, and in other cases the colony widens towards the base but narrows again at the immediate area of attachment. The largest colony (St. 148), measures, in the preserved state, 460 cm., but a label with the specimen showed that an earlier measurement, probably in the fresh state, was 485 cm. Even this colony was not intact. Another specimen was part of a 'strip floating on the surface', 20–25 ft. long. This floating fragment, over 7 m. in length, represents one of the longest specimens ever recorded.

In alcohol the colony is usually a dull greyish green, but the collector of the large floating strip has given the following description of the fresh colony: 'general colour pale yellow white; details of colour: background pale indeterminate, zooids bright creamy white'.

ZOOID. Ärnbäck (1949, 1950) has shown that, contrary to the belief of previous workers, the zooids are hermaphrodite, with the testis maturing before the ovary. The material on which she worked was part of the 'Discovery' collection (St. 149), which I have been able to re-examine. This and other specimens show that the zooid in the fully developed female condition has two large eggs. Two embryos, or occasionally three, are found in the brood pouch.

BIOLOGY. (*a*) *Breeding*. The breeding condition of all colonies in the 'Discovery' collection is shown in Table 24. The zooids are classed as 'well developed male', in which the testis is moderate or large; 'well developed female', with moderate or large eggs in the ovary; and 'with embryos', in which the brood pouch contains one, two, or three developing embryos. No colonies were collected in the winter months of May to September, but enough material was taken during the rest of the year to show that zooids were already well advanced as males in October and that the testis was present from then on until January when it began to regress. In October and November the ovary had not yet started to develop, in December and January it was large, and thereafter decreased. The presence of eggs or embryos in the samples of December, March and April indicates a breeding season confined to the southern summer. No fully developed larvae were seen in any of the zooids during that period, perhaps owing to a long period of incubation. If this is so larval settlement is not likely to take place before April.

Zooids in different parts of a colony are in different sexual conditions. One large colony of 130 cm. illustrates this (St. 366). Zooids are absent from the basal 6 cm. of the colony. Zooids at 10 cm. from the base have no gonads, no brood pouch, and no embryos. Some zooids at 20 cm. from the base have an ovary and others have not, and some zooids have a spherical brood pouch, but without embryos.

At 30 cm. the gonad has disappeared but many of the zooids have two embryos in the brood pouch, and this is the usual condition throughout the rest of the colony, with some variations in the state of the ovary.

This grading of sexual development in the zooids indicates that towards the base of the colony the zooids are younger than those higher up the colony, and is to be expected in forms with a linear arrangement of the zooids (e.g. *Sycozoa*) but not necessarily in *D. cylindrica* which has small oval systems. In some at least of the colonies which have embryos the zooids contain very little or no food in the gut, and it is likely that the zooids become moribund once the eggs are passed into the brood pouches. Specimens collected in April and containing embryos had non-functional zooids and some colonies lacked zooids altogether. None of the colonies in the collection showed any sign of the accumulation of reserve materials or other provision for overwintering and how the species passes through the winter is not known.

Table 24

Month	*May*	*June*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*	*Jan.*	*Feb.*	*Mar.*	*Apr.*
Well-developed male	—	—	—	—	—	2	3	3	1	—	0	0
Well-developed female	—	—	—	—	—	0	0	4	3	—	1	0
With embryos	—	—	—	—	—	0	0	1	0	—	3	1

(*b*) *Feeding*. The contents of the gut show one or two interesting features. In the branchial sac of zooids in several colonies there was much coarse sand as well as organic matter (Pl. VI, figs. 4, 5), but the stomach and intestine showed no large sand grains, (Pl. VI, fig. 3). Unless this is an artifact produced in some way during collection or handling of the specimens, there seems to be some kind of sorting mechanism at work between the branchial sac and the stomach, a feature noticed in other and unrelated species (see p. 146). Coarse matter is present in the branchial sac right up to the mouth of the oesophagus, but none enters the oesophagus. That the mechanism is not simply one which excludes large particles is indicated by the presence of some diatoms in the intestine, equal in size to the sand grains which are excluded. The oesophagus perhaps accepts mainly organic matter, or particles with a smooth surface, but I do not know which of these characters is the important one or how the selection mechanism works. There must be an accumulation of sand particles in the branchial sac which is presumably cleaned at intervals by thoracic contractions expelling the whole contents of the branchial sac.

Distribution. Antarctic (Graham Land, Kaiser Wilhelm II Land, MacRobertson Land, South Georgia, South Sandwich Islands), Subantarctic (Patagonian Shelf, Strait of Magellan).

Genus Hypsistozoa Brewin, 1953

Hypsistozoa fasmeriana (Michaelsen) (Text-fig. 22, Pl. III, fig. 2)

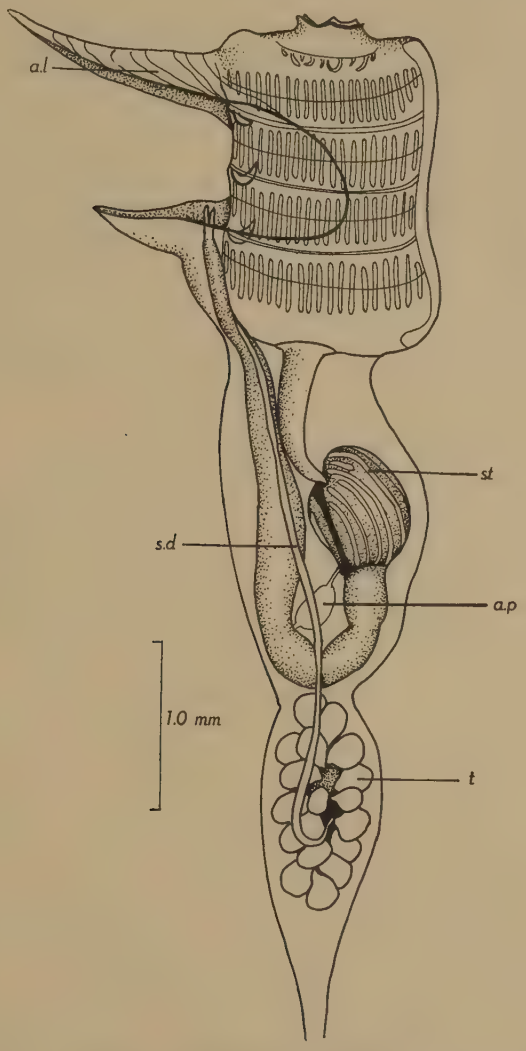
Distaplia fasmeriana Michaelsen, 1924.
Hypsistozoa fasmeriana Brewin, 1953, p. 56.

Occurrence. St. 935: North Island, New Zealand, 84 m.

Colony (Pl. III, fig. 2). The single specimen of this interesting species is a colony with head 1·3 cm. long and 1·1 cm. wide, borne on a stalk 1·6 cm. long and 0·7 cm. wide. The head is greyish brown and the stalk dull pale orange; both are smooth and without any encrusting matter. Rows of zooids are visible through the test; the systems are in fact long narrow elipses, but so narrow that the zooids have the appearance of being arranged in double rows. The common cloacal openings, of which there are several, are scattered on the surface of the colony, but are largely confined to the distal part. Each opening is round or oval and is bordered by a projecting rim of test.

Zooid (Text-fig. 22). The zooids agree closely with Michaelsen's (1924) detailed description, except that the stomach (*st.*) of the 'Discovery' specimens has rather more folds, there being up to twenty instead of fifteen as noted by Michaelsen.

Gonads. Many of the zooids in the 'Discovery' colony have no trace of gonads, but in a few there is a large testis (*t.*), consisting of many closely packed small orange-coloured follicles forming a long body situated entirely behind the loop of the intestine. The sperm duct (*s.d.*) is sinuous or hooked at



Text-fig. 22. *Hypsistozoa fasmeriana* (Michaelsen) (St. 935): Zooid.

its origin. No female gonads were seen, although, as Brewin (1946) has shown, the zooids are hermaphrodite. There were also no brood pouches.

Remarks. The species was very carefully described by Michaelsen (1924) who, in the absence of gonads in his specimens, put it in the genus *Distaplia*. But Brewin (1946) found specimens with gonads which projected into the right anterior part of the vascular process, and she later erected a new genus *Hypsistozoa* for the species (Brewin, 1953).

The annual cycle and the complex and interesting embryonic development have been described in detail by Brewin (1956*a*).

DISTRIBUTION. *H. fasmeriana* has been previously recorded from Stewart Island, to the south of South Island, New Zealand (Michaelsen, 1924) and from Christchurch, South Island, New Zealand, and East Cape, North Island, New Zealand (Brewin, 1946, 1950, 1951, 1953). The 'Discovery' record considerably extends the range northwards. The species seems to be confined to the New Zealand region, but within that region it exists in the different temperature conditions which prevail at the extreme south and extreme north of these islands.

Genus **Cystodytes** von Drasche, 1884

Cystodytes dellechiajei (Della Valle)

Distoma dellechiajei Della Valle, 1877, p. 40.
For synonymy see van Name (1945), p. 133.

OCCURRENCE. St. 934: North Island, New Zealand, 98 m. St. 935: North Island, New Zealand, 84 m. St. WS 871: Patagonian Shelf, 336–342 m.

COLONY. The several colonies collected from St. 935 are ovoid rather than flat and encrusting; the largest is 3·0 cm. in length. The colony from St. 934 has its outline broken by a number of projecting lobes.

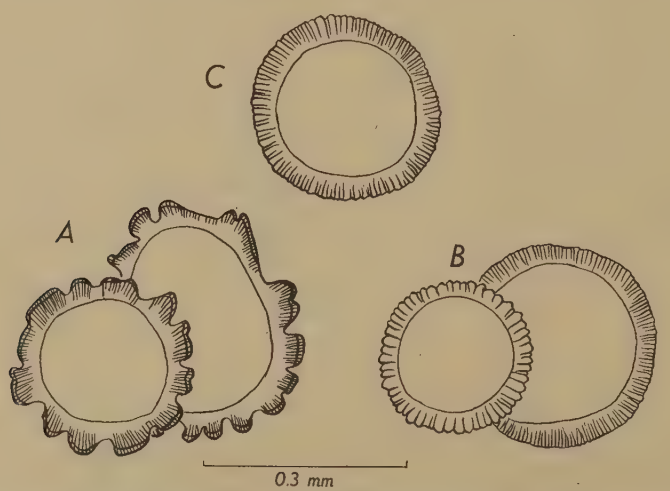
DISTRIBUTION. This species is very widely distributed, mainly in tropical and subtropical waters. It also extends to the more temperate waters of New Zealand and the Chatham Islands (Brewin, 1948, 1951, 1952, 1956*b*).

C. dellechiajei f. **antarctica** (Sluiter) (Text-fig. 23)

Cystodytes antarcticus, Sluiter, 1912, p. 460; 1914, p. 27; Ärnbäck, 1950, p. 26, pl. 5, fig. 25, text-figs. 6–8.

OCCURRENCE. St. 181: Palmer Archipelago, 160–335 m. St. 190: Palmer Archipelago, 93–126 m.

COLONY. Several colonies were collected from the Palmer Archipelago, and the largest of these measures 6 cm. long by 1·5 cm. wide and about 1·5 cm. thick. This colony is considerably larger than



Text-fig. 23. *Cystodytes dellechiajei* (Della Valle): A, spicules of f. *antarctica* (St. 190); B, spicules of typical form (St. 934); C, spicules of typical form (St. WS 871)

any collected by the second Charcot Expedition or the Swedish Antarctic Expedition of 1901–3, the only two expeditions which have hitherto taken the form.

The disc-shaped spicules (Text-fig. 23 A), which reach 0·3 mm. in diameter, have a crenelated margin, as described by Ärnbäck (1950).

Zooid. The zooid is much as described by Ärnbäck, but there is only a relatively short waist joining the thorax and abdomen. This condition may have resulted from contraction.

Larva. No fully developed larvae were found in any of the colonies, but the large colony from St. 190 had some advanced embryos with the tail differentiated. These embryos had a length of 1·1 to 1·2 mm.

Remarks. Sluiter (1912) described a species *C. antarcticus*, which Ärnbäck (1950) retained, but thought would very probably prove to be a form of *C. dellechiajei*, if more material could be studied.

The only way of distinguishing *C. dellechiajei* and *C. antarcticus*, other than by their distribution, is by the shape of the spicules. All antarctic specimens so far examined, including the 'Discovery' ones, have spicules with a distinctly crenelated margin (Text-fig. 23 A). Specimens from other regions have the margin smooth or minutely notched (Text-fig. 23 B, C), but there is sufficient variation in the size and distinctness of the notches to render doubtful the value of this character for separating species. I therefore propose that the present specimens, together with those previously called *C. antarcticus*, should be recognized as a form *antarctica* nom.nov. of *C. dellechiajei*.

Distribution. The form *antarctica* is recorded only from the vicinity of Graham Land.

Subfamily Atapozoinae Brewin, 1956

Genus Atapozoa Brewin, 1956

Atapozoa marshi Brewin (Text-fig. 24)

Atapozoa marshi Brewin, 1956*c*, p. 31, fig. 1.

Occurrence. St. 935: North Island, New Zealand, 84 m.

Colony (Text-fig. 24 A, B). There are two specimens. The larger has a cylindrical stalk 1·3 cm. long and an ovoid head 1·0 cm. long. In the smaller specimen the stalk is only 0·3 cm. in length and the head is globular, with a diameter of about 1·0 cm. In each the stalk is encrusted with white shelly debris but the head is bare. The zooids, which are confined to the head, are seen through the test as orange-brown bodies. The test is semi-transparent and firm, but contains no 'kotballen' (masses of foreign matter) which Brewin found in her specimens.

Zooid (Text-fig. 24 C). Large zooids in which the abdomen is well developed reach a total length of 3·4 mm.; zooids with a short abdomen are little more than half that length. The siphons are both provided with six distinct lobes. Eighteen to twenty longitudinal muscles are present on each side of the thorax, and converge to form a more compact band of muscle which extends down the whole length of each side of the abdomen. Some zooids have a short vascular process (*v.pr.*) at the lower end of the abdomen. A small thin-walled projection from the base of the dorsal side of the thorax (*b.p.*) is present in some zooids and may represent the brood pouch described by Brewin. The whole body is of an orange-brown colour when preserved in alcohol.

Branchial sac. Details are difficult to distinguish owing to the contraction of the thorax. The oral tentacles are closely spaced and number at least twenty. There are three rows of stigmata but the number in each row could not be determined; they probably exceed twenty. The hooked dorsal languets on the two transverse bars are quite prominent.

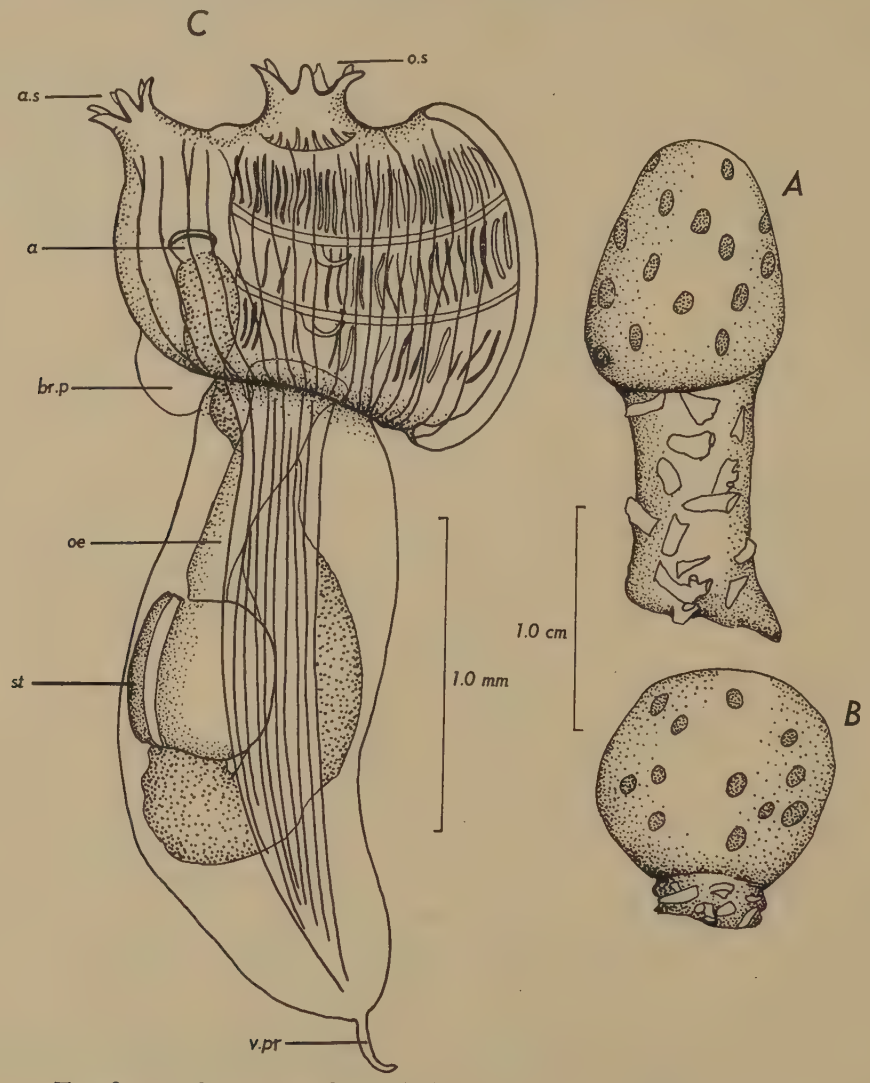
Gut. The oesophagus (*oe.*) is nearly twice as long as the stomach, and in this respect differs from Brewin's type specimens most zooids of which had a short oesophagus. The stomach (*st.*) is smooth-walled and the intestinal loop short, without any apparent divisions. In the type specimens the anus was smooth-edged; in the 'Discovery' material the anus (*a*), which lies opposite the second row of stigmata, has two lips.

Gonads. Gonads were not developed in the present specimens.

REMARKS. The genus *Atapozoa* was erected by Brewin (1956*c*) for a species found at Trigg Island, near Perth, Western Australia. *Atapozoa* differs from *Eudistoma* in having a stalked brood pouch, and only two anterior papillae in the larva instead of three.

There were no larvae in the 'Discovery' specimens, and the brood pouch, if present at all, was in a rudimentary state. The identification therefore rests on the other characters of the zooid and on the structure of the colony, in all of which features there is close agreement with the type specimens.

DISTRIBUTION. Western Australia; North Island, New Zealand.



Text-fig. 24. *Atapozoa marshi* Brewin (St. 935): A, B, two colonies; C, zooid.

Suborder PHLEBOBRANCHIATA Lahille, 1886

Family DIAZONIDAE Garstang, 1891

Genus Tylobranchion Herdman, 1886

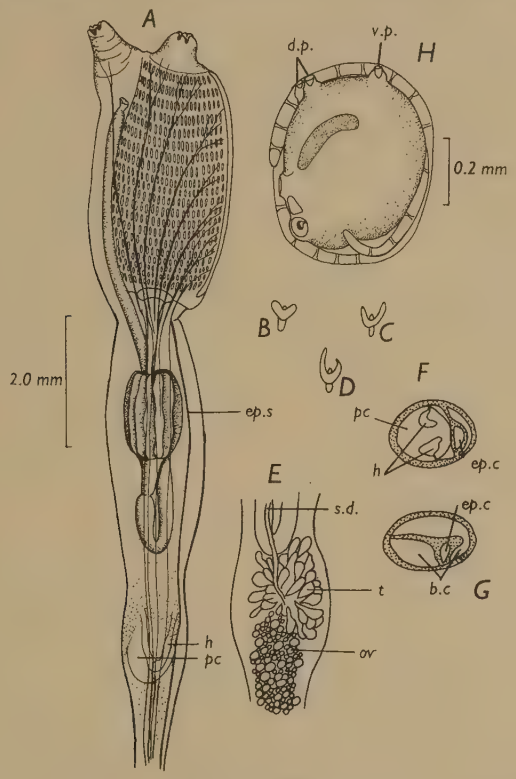
Tylobranchion speciosum Herdman (Text-fig. 25; Pl. III, fig. 1)

Tylobranchion speciosum Herdman, 1886, p. 157, pl. 22, figs. 1–17.

For synonymy see Kott (1954), p. 152.

Occurrence. St. 123: S. Georgia, 230–250 m. St. 144: S. Georgia, 155–178 m. St. 160: Shag Rocks, 177 m. St. 371: S. Sandwich Islands, 99–161 m. St. WS 27: S. Georgia, 104 m. St. WS 243: Patagonian Shelf, 144–141 m. St. WS 841: Patagonian Shelf, 110–121 m.

Colony. The largest specimen in the collection is one from the Patagonian Shelf (St. WS 841), measuring 9 cm. tall, 1·5 cm. thick, and 7 cm. long. The original colony must have been still larger, as the specimen is only a portion. In form the colonies (Pl. III, fig. 1) are generally pillar-like, wedge-shaped, or club-shaped and are often markedly flattened from side to side. The test is firm but not hard, sometimes almost clear and occasionally nearly opaque. Some of the colonies from South Georgia and the Patagonian Shelf are reddish brown in colour. In most specimens the zooids are



Text-fig. 25. *Tylobranchion speciosum* Herdman: A, zooid (St. WS 27); B, C, D, branchial papillae from different specimens (Sts. WS 27, 371, WS 243); E, gonads; F, transverse section of zooid at level of heart; and G, below level of heart; H, larva (St. 144).

readily visible through the test. Attachment of the colony is usually to a small group of pebbles embedded in the basal test.

Zooid (Text-fig. 25 A). The general structure of the zooid is already known, and the principal variations in the 'Discovery' specimens are tabulated on page 86. Certain points regarding the lower part of the zooid, however, have remained doubtful. Berrill (1935) described a true post-abdomen containing the heart and gonads, but Ärnbäck (1927, 1950) showed that the heart is much farther forward than Berrill's figure indicated. A careful examination of the 'Discovery' specimens allows me not only to confirm Ärnbäck's findings, but also to add details concerning the epicardium and the nature of the posterior part of the zooid. The epicardium is a flattened tube forming a partition across the abdomen. Extending from just below the base of the thorax, it reaches the pericardium (*pc.*) but instead of ending there it continues into the lower, narrow part of the zooid where it forms a partition separating the two blood channels (Text-fig. 25 G, *b.c.*). This part of the zooid behind the heart also

contains muscles of the body wall and is not homologous with the vascular process which occupies a similar position in the related *Diazona*. In *Diazona* the vascular process has a mesenchymatous septum and no extension of the epicardium.

Gonads (Text-fig. 25E). Specimens collected in July (St. WS 243, Patagonian Shelf), and March (St. 371, South Sandwich Islands) had well-developed gonads consisting of bunched testis follicles (*t.*) at the lower end of the intestinal loop, and an elongated ovary (*ov.*) below the testis.

Larva (Text-fig. 25H). Two of the specimens carry larvae. One colony from the Patagonian Shelf (St. WS 243), collected in July, has only three larvae in the zooids, and one colony from South Georgia (St. 144) collected in January, has many larvae in each breeding zooid. Only the latter

Table 25

Species or material	*Height of colony (cm.)*	*Length of zooids (mm.)*	*Thoracic muscles*	*Branchial papillae*	*Stomach folds*	*Distribution or occurrence*
T. antarcticum	Up to 2	Thorax 2, abdomen 2·75	7 or 8	Tall; processes long	Sinuous and narrow	E. and W. Antarctic
T. speciosum	—	Thorax 4–5, abdomen 7–8	Numerous (about 11?)	Flattened; processes short	About 17, slightly sinuous	Kerguelen
T. weddelli	—	Thorax 7–8, abdomen 7	9 or 10	Flattened; processes short	14, straight	W. Antarctic
'Discovery' St. 144 (4 colonies)	1·6–2·7	Thorax 3·5–5·0, abdomen 3·0–5·5	6–8	Short; processes quite long	17–19; mostly straight	S. Georgia
'Discovery' St. WS 27 (18 colonies)	1·6–5·0	Thorax 2·0–6·0, abdomen 3·0–7·0	7–12	Short with short processes or long with long processes	12–18, mostly straight, but some sinuous in some zooids	S. Georgia
'Discovery' St. 371 (2 colonies)	3·0, 3·5	Thorax 6–7, abdomen 7–9	8–11	Long; processes long	12–16, straight	S. Sandwich Is.
'Discovery' St. WS 243 (1 colony)	4·5	Thorax 4, abdomen 5	7	Long; processes long	Apparently smooth	Patagonian Shelf
'Discovery' St. WS 841 (piece of 1 colony)	Piece, 7 by 9	Thorax 3, abdomen 3	7–10	Short; processes short	10–12	Patagonian Shelf
'Discovery' St. 160 (2 colonies)	4·5, 4·0	Thorax 5–6, abdomen 3–5	6–8	Short; processes short	15 or 16	Shag Rocks

specimen has fully developed larvae. These measured about 0·55 mm. from the end of the papillae to the base of the tail. There are two short dorsal papillae (*d.p.*) placed close together, and one short ventral papilla (*v.p.*), the three arranged to form a triangle. The trunk is deep and rounded. Within the cerebral vesicle the black otolith projects from the floor, but there is no trace of a pigmented ocellus.

Remarks. Three species of *Tylobranchion* have been described from southern waters, *T. speciosum*, Herdman, *T. antarcticum* Herdman, and *T. weddelli* Ärnbäck. Van Name (1945) doubted whether they are distinct, and Kott (1954), after examining material from the B.A.N.Z. Antarctic Research Expedition of 1929–31 decided that they all represent one species. But Ärnbäck (1950) still maintained their separation. I have to record, however, that in her personal notes, to which I have had access, she seemed to have found less clear distinctions between the species represented in the 'Discovery' collections. The characters shown in Table 25 include those used by Ärnbäck to separate the three species. They show such a degree of overlapping that I am accepting Kott's (1954) view of the identity of the species, the name *T. speciosum* having priority.

The systematic position of the genus has been much discussed. Originally placed in the family Polyclinidae by Herdman (1886), it is now generally regarded as a phlebobranchiate ascidian, related to, or actually within, the family Diazonidae. The larva, with its triangular arrangement of the papillae, also shows that the genus should be removed from the Polyclinidae.

The 'Discovery' records are of special interest as they extend the known range northwards to the edge of the Antarctic and beyond into the Subantarctic (Patagonian Shelf). Ärnbäck (1950) had already recorded the species (as *T. antarcticum*) from South Georgia, at that time the most northern locality.

DISTRIBUTION. Antarctic (Cape Adare, MacRobertson Land, Kaiser Wilhelm II Land, Graham Land, South Georgia, South Shetland Islands, South Sandwich Islands), Subantarctic (Patagonian Shelf).

Family ASCIDIIDAE Adams, 1858

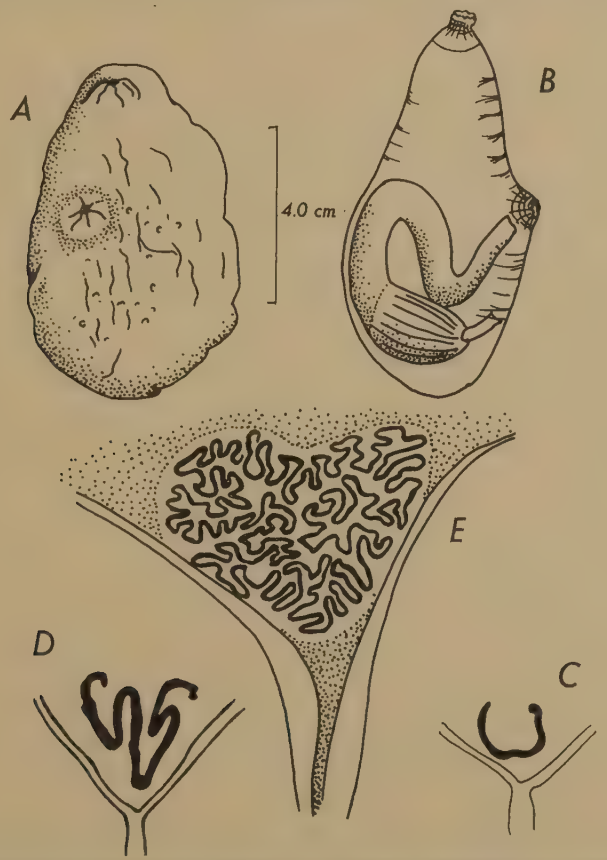
Genus Ascidia Linnaeus, 1767

Ascidia translucida Herdman (Text-fig. 26)

Ascidia translucida Herdman, 1880, p. 466.
?*Ascidia plicata* Kott, 1954, p. 150, fig. 31.

OCCURRENCE. St. 39: S. Georgia, 179–235 m. St. WS 25: S. Georgia, 18–27 m. St. MS 10: S. Georgia, 26–18 m. St. MS 65: S. Georgia, 39 m. St. MS 68: S. Georgia, 220–247 m.

EXTERNAL APPEARANCE (Text-fig. 26A). The largest of the six specimens is 19·0 cm. long and the



Text-fig. 26. *Ascidia translucida* Herdman (St. MS 68): A, external appearance; B, specimen with test removed; C, D, E, dorsal tubercles of small, medium and large specimens, respectively.

smallest 1·5 cm. long. The size of the largest animal is greater than any yet recorded for this species, unless we accept *A. plicata* Kott as a synonym, Kott having recorded specimens of that species up to 29 cm. in length (see below for a discussion of *A. plicata*).

Dorsal tubercle. The species is distinguished mainly by the very complex form of the opening of the dorsal tubercle. The large specimens in the 'Discovery' collection show this feature but in smaller ones the opening is much simpler, and a series of increasing complexity can be seen (Text-fig. 26C–E).

Oral tentacles and branchial bars. The numbers of oral tentacles and of longitudinal branchial bars are given in Table 26, for specimens of different sizes.

Table 26

Length of body (cm.)	*No. of tentacles*	*No. of longitudinal bars*
19·0	18	39
8·5	16	36
8·2	21	25
7·5	25	40
2·9	36	27
1·5	19	20

These figures give the total numbers of tentacles, including the smallest visible ones. If the larger and more conspicuous tentacles only are counted, the numbers would be reduced by one-third to one half. The number of tentacles does not increase steadily with growth of the body; in fact there is a tendency for large animals to lose tentacles.

Branchial sac. The wall of the branchial sac is plicate, as noted by Herdman (1882). I have found that in large specimens the plication is complex, as the walls of each fold are thrown into a series of lesser folds, as described by Kott (1954) in her species *A. plicata*. Correlated with this folding there has developed immediately external to the perforated wall, a flat sheet of tissue extending over the whole outer surface of the wall. This sheet represents an expansion of the outer part of the transverse bars, and serves to support the folded stigmatic wall. The sheet is pierced by transverse rows of slit-like openings by which alone the water may escape from the branchial cavity to the surrounding peribranchial cavities.

The papillae of the branchial sac are large, and in some places intermediate papillae may be seen, but these seem usually to be associated with the growth of new transverse bars.

Remarks. *A. translucida* is readily distinguished by its dorsal tubercle from other Antarctic and Subantarctic species except *A. plicata* Kott (1954) in which a similar tubercle has been described. Kott states that this species is distinguished from *A. translucida* by (1) the branchial wall with primary and secondary folds, (2) the atrial siphon one-third to one half of the body length from the oral siphon, and (3) the absence of secondary branchial papillae.

I believe that the branchial wall of *A. translucida* is essentially the same as that described for *A. plicata*. The type specimen of *A. translucida*, which Herdman described and illustrated, was only 2·2 cm. in length, and a specimen of this small size might be expected to have a simple type of folding in the branchial sac. The 'Discovery' specimen of 2·9 cm. length has only slight folding of the wall, and the smallest specimen available, of length 1·5 cm., shows no folding at all. There is, therefore, a gradual increase in complexity with increasing age and size.

The second feature used to distinguish *A. plicata*, the distance of the atrial siphon from the anterior end of the body, does not in fact separate the two species, in each of which the distance is between one-third and one half of the body length.

The third criterion, the presence or absence of intermediate papillae in the branchial sac, is also an unreliable character. In *A. translucida*, Hartmeyer (1912) found that secondary papillae were present in older specimens but not in younger ones. Ärnbäck (1938) also noted that in *A. translucida* these papillae exist in some parts of the branchial sac but not in others.

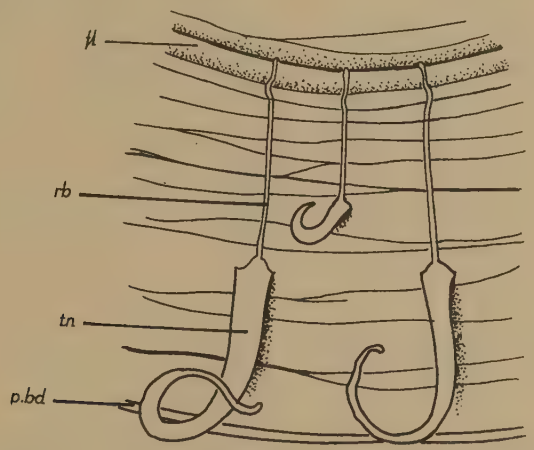
For these reasons I regard *A. plicata* as very probably a synonym of *A. translucida.*

Distribution. Antarctic (South Georgia), Subantarctic (Kerguelen).

Ascidia challengeri Herdman (Text-fig. 27)

Ascidia challengeri Herdman, 1882, p. 102, pl. 30.
Ascidia charcoti Sluiter, 1905, p. 471.
Ascidia dispar Ärnbäck, 1938, p. 48; text-fig. 11.

Occurrence. St. 145: S. Georgia, 26–35 m. St. 156: S. Georgia, 200–236 m. St. 160: Shag Rocks (S. Georgia), 177 m. St. 164: S. Orkneys, 24–36 m. St. 195: S. Shetlands, 391 m. St. 1652: Ross Sea, 567 m. St. 1660: Ross Sea, 351 m. St. WS 27: S. Georgia, 107 m. St. MS 71: S. Georgia, 110–60 m. B.G.L.E., 1934–7, Stella Creek.



Text-fig. 27. *Ascidia challengeri* Herdman (St. 145): Oral tentacles.

External appearance. The specimens range in length from 1·3 cm. to 11·0 cm., the largest being from the Ross Sea. They vary from a regular oval and laterally flattened form to an irregular pear-shaped form. The siphons are generally, but not always, inconspicuous, the oral one terminal and the atrial about one-third of the body length from it.

Table 27

	A. dispar	*A. challengeri*
No. of tentacles	About 50	Few, usually up to 20
Dorsal lamina	Extends far beyond oesophageal mouth	Scarcely extends beyond oesophageal mouth
No. of longitudinal branchial bars per side	40–50	30–32
Intermediate branchial papillae	Absent	Usually present
Branchial stigmata	Short and irregular	Long and regular

Remarks. Ärnbäck (1938) described a new species *A. dispar*, based on a single specimen from South Georgia. She recognized the strong similarity to *A. challengeri*, but gave as main distinctions those shown in Table 27.

Of these characters the ones which, judging by distinctions between other species of *Ascidia*, are likely to be the most reliable are (1) the number of tentacles, (2) the number of longitudinal branchial

bars, and (3) the presence or absence of intermediate branchial papillae. In Table 28 I have shown the variation in the 'Discovery' specimens in respect of these three characters. A fourth character which I have added is the presence or absence of a rib running forward along the inner siphonal wall from the base of each tentacle (Text-fig. 27, *rb.*). This is a feature which I noticed in some specimens and which is illustrated but not mentioned by Herdman (1923, pl. 13, fig. 1) in *A. challengeri*. Inspection of the way in which these characters are distributed among the specimens shows that it is impossible to maintain the distinctions made by Ärnbäck in establishing *A. dispar*, which I therefore regard as a synonym of *A. challengeri*.

Table 28

Station	156	160	*WS* 27	156	*MS* 71	145
Locality	*S. Georgia*	*Shag Rocks*	*S. Georgia*	*S. Georgia*	*S. Georgia*	*S. Georgia*
No. of tentacles	40–43	30	48–50	26	50–55	29
No. of longitudinal branchial bars	50–53	60	About 39	28	About 40	32
Intermediate branchial papillae	Present	Present	?	Absent	Present in places	Absent
Tentacle ribs	Absent	Absent	?	?	Present	Present

Station	164	1652	1660	195	*B.G.L.E.*
Locality	*S. Orkneys*	*Ross Sea*	*Ross Sea*	*S. Shetlands*	*Stella Creek*
No. of tentacles	18	12–15	26	11–16	12–14
No. of longitudinal branchial bars	38–40	54–58	36	33	27–32
Intermediate branchial papillae	Present	Present	Present	Present	Present in places
Tentacle ribs	Absent	Present	?	?	Present or absent

Two other species seem to be closely related, if distinct: *A. placenta* Herdman, and *A. meridionalis* Herdman. Herdman (1923) himself suggested that *A. meridionalis* might prove to be the same as *A. challengeri*.

Distribution. Antarctic (South Georgia, Graham Land, South Orkneys, South Shetlands, Kaiser Wilhelm II Land, Wilkes Land, King George V Land, Ross Sea), Subantarctic (Kerguelen).

Ascidia interrupta Heller (Text-fig. 28)

Ascidia interrupta Heller, 1878, p. 89, pl. 2, fig. 9.
For synonymy see van Name, 1945, p. 182.

Occurrence. St. 279: French Congo, West Africa, 58–67 m.

External appearance (Text-fig. 28A). The three specimens are 7·3 cm. long by 3·0 cm. wide, 7·4 by 5·0 cm., and 7·6 by 2·8 cm. The shape is long and rather narrow, but the outline is irregular and the surface of the body has swellings and depressions. At the anterior end the body is slightly narrowed towards the oral siphon (*o.s.*). The atrial siphon (*a.s.*) is scarcely marked externally. It is situated between one half and two-thirds of the body length from the anterior end.

Test. The test is fairly thick, hyaline and cartilaginous in appearance, and is semi-transparent.

Body wall. The left side of the body has few muscles, and on the right side the muscles form a loose irregular, but mainly transverse, mesh of slender strands. When the test has been removed, the oral siphon is seen to be a narrow, but not very long tube, and the atrial siphon a short conical tube projecting almost at right angles to the long axis of the body.

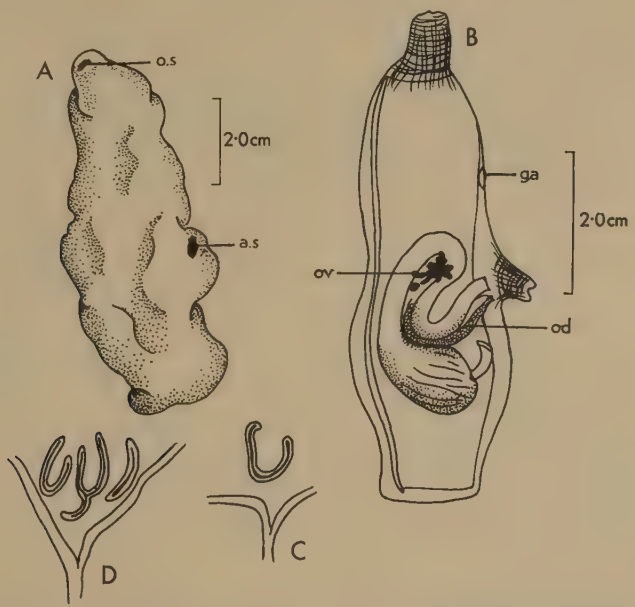
Tentacles. There are from eighty to 110 oral tentacles in the 'Discovery' specimens. They are slender and closely crowded.

Dorsal tubercle. In one of the specimens examined, the dorsal tubercle is of a simple U-shape, with the right limb a little turned inwards (Text-fig. 28C). In another specimen the opening is broken up into a number of irregular pieces, but is still basically U-shaped (Text-fig. 28D).

Branchial sac. There are fifty to sixty longitudinal bars on each side of the branchial sac.

Gut. The gut (Fig. 28B) is very like that illustrated by van Name (1945, fig. 97).

Gonads. In all three specimens the testis is poorly developed, and the ovary is a small slightly lobed body lying within the intestinal loop (Text-fig. 28B, *ov.*).



Text-fig. 28. *Ascidia interrupta* Heller (St. 279): A, external appearance; B, specimen with test removed; C, D, dorsal tubercles of two specimens.

Remarks. These animals from the French Congo, West Africa agree very closely with the detailed description given by van Name (1945) of the species as it occurs on the tropical coasts of the American side of the Atlantic. So far as I am aware, it has not been recorded hitherto from the African coast and the 'Discovery' specimens are from deeper water than previous records. This is a further example of the distribution of a tropical species on both sides of the Atlantic.

Distribution. East coast of tropical America; French Congo, West Africa.

Ascidia sydneiensis Stimpson (Text-fig. 29)

Ascidia sydneiensis Stimpson 1855, p. 387.
For synonymy see van Name 1945, p. 189.

Occurrence. St. 90: False Bay, S. Africa, 0–2 m. St. 1686: Victoria, Australia, 0 m.

External appearance. The specimen from False Bay, South Africa is 5·0 cm. long and 3·0 cm. wide. The specimen from Victoria, Australia is 9·2 cm. long and 6·9 cm. wide.

Internal structure. Both specimens are quite typical of this species. Each shows the characteristic bands of muscles on the right side (Text-fig. 29B), the large number of oral tentacles (150–200), and the complex dorsal tubercle.

Remarks. In the South African individual the gut is full of food, consisting largely of algal cells, diatoms and peridineans with a certain amount of coarser inorganic matter.

Distribution. Widely distributed throughout the warmer and temperate waters of the world.

Family AGNESIIDAE Huntsman, 1912

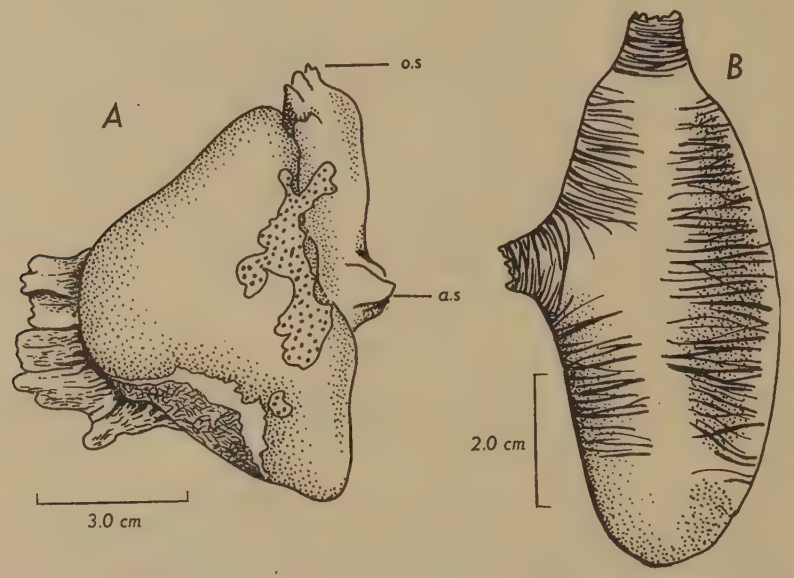
Genus Agnesia Michaelsen, 1898

Agnesia glaciata Michaelsen (Text-fig. 30)

Agnesia glaciata Michaelsen 1898, p. 370.
Agnesia krausei Michaelsen, 1912, p. 181, figs. 24, 25.
Agnesia capensis Millar, 1955, p. 191, fig. 19.

Occurrence. St. 91: False Bay, S. Africa, 35 m. St. 939: N. Island, New Zealand, 87 m. St. WS 775: Patagonian Shelf, 115–110 m.

External appearance. The two specimens from the Patagonian Shelf have lengths of 17 and 10 mm. The single specimen from False Bay, South Africa, is 9 mm. long and the largest of those from north of New Zealand is 12 mm. long. In most cases the body is rectangular in outline. In all specimens the test is thin and very transparent, but is hidden to a variable degree by the sand or broken shell



Text-fig. 29. *Ascidia sydneiensis* Stimpson (St. 1686): A, external appearance of specimen; B, same specimen with test removed.

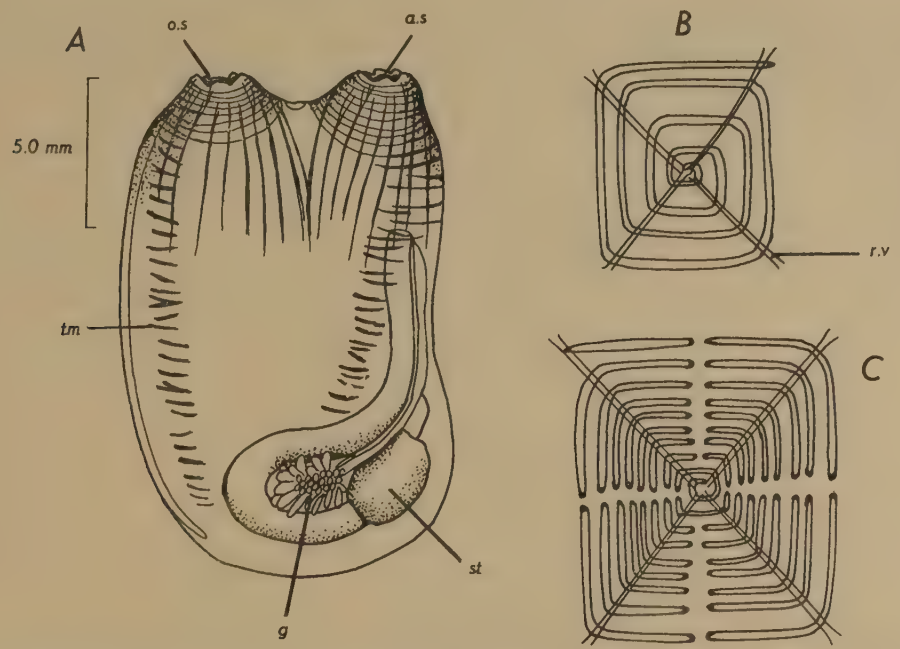
which adheres to it. This coating of sand is most complete in the specimens from New Zealand and least in those from the Patagonian Shelf. Test hairs are sparsely developed in the specimens from the Patagonian Shelf and South Africa, but appear to be absent in the New Zealand specimens.

Musculature (Text-fig. 30A). The same arrangement of muscles is found in all the specimens, but the degree of development varies. Longitudinal muscles radiate out from the two siphons and pass downwards across the upper part of the body. Strong circular muscles are present on both siphons, round which they form complete rings. Posterior to the siphons the circular muscles are represented by four longitudinal series of short transverse bands (*t.m.*), one series near the dorsal and one near the ventral margin of each side of the body. When the body is contracted these short transverse bands are inconspicuous, and this may possibly account for the omission of any reference to them by Michaelsen (1898, 1900) in his descriptions of *A. glaciata* and *A. krausei*.

Remarks. *A. glaciata*, the type species of the genus, was found off Tierra del Fuego and described by Michaelsen (1898, 1900); he subsequently described another species, *A. krausei*, from the Patagonian Shelf. A single specimen from Table Bay, South Africa, was made the type of a third species,

A. capensis (Millar, 1955). The three descriptions are very similar, as may be seen by the comparison of the diagnostic characters given in Table 29. Details of the 'Discovery' specimens are included.

It is evident from the table below that both the number of turns of the stigmata, and whether the stigmata are undivided (Text-fig. 30B) or divided (Text-fig. 30C) depend on the size of the specimen. The distinctions between *A. krausei* and *A. glaciata* therefore break down. As van Name (1945) pointed out *A. krausei* is to be regarded as a young stage of *A. glaciata*, because division of the stigmata is likely to occur in older specimens. Having now been able to examine a second specimen



Text-fig. 30. *Agnesia glaciata* Michaelsen: A, specimen from Patagonian Shelf (St. WS 775); B, stigma of specimen from False Bay, S. Africa (St. 91); C, stigma of specimen from St. WS 775.

Table 29

	A. krausei	*A. glaciata*	*A. capensis* (type specimen)	'Discovery' St. 91 (S. Africa)	'Discovery' St. WS 775 (Patagonian Shelf) Specimen 1	Specimen 2	'Discovery' St. 939 (New Zealand)
Length of body (mm.)	Up to 9	Up to 18	11	9	10	17	12
No. of turns of stigmata	4–5	7–9	3–5	4	5	9	5
Nature of stigmata	Undivided	Divided	Divided	Undivided	Divided	Divided	Undivided
Radial stigmatic vessels	Present	Present	Absent	Present	Present	Present	Present

of *Agnesia* from Table Bay, South Africa, I find that this one possesses radial vessels across the stigmata (Text-fig. 30B, *r.v.*), and conclude that my earlier observation (Millar, 1955) was incorrect or based on poor material. The distinction between *A. capensis* and *A. glaciata* also disappears, and one species, *A. glaciata*, remains. All specimens of *Agnesia* in the 'Discovery' collection can be referred to *A. glaciata*, which appears to be a species of wide distribution in southern waters.

DISTRIBUTION. Subantarctic (Magellan region); South Africa; north of New Zealand.

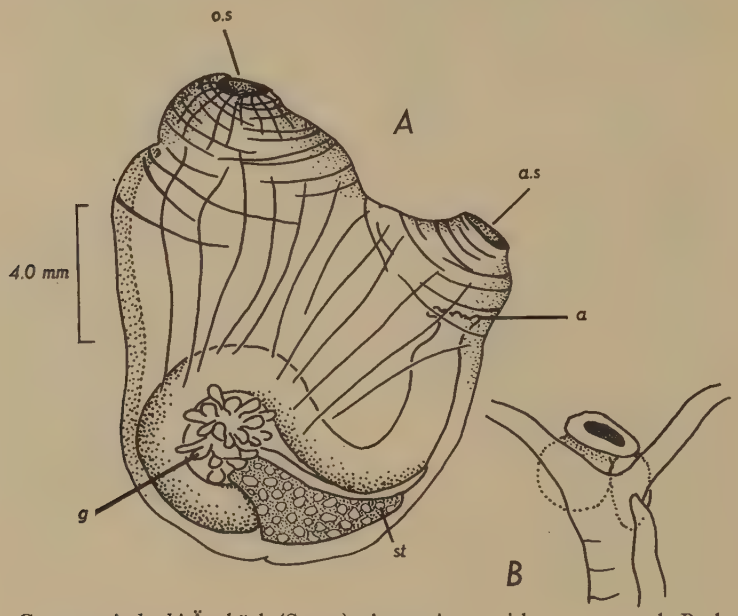
Genus Caenagnesia Ärnbäck, 1938

Caenagnesia bocki Ärnbäck (Text-fig. 31)

Caenagnesia bocki Ärnbäck, 1938, p. 41, pl. 2, figs. 20–22.
Agnesia complicata Kott, 1954, p. 151, figs. 32, 33.

Occurrence. St. 42: S. Georgia, 120–204 m. St. 181: Palmer Archipelago, 160–335 m. St. 182: Palmer Archipelago, 278–500 m.

External appearance. The shape of these specimens is very much as described by Ärnbäck (1938). In some of them there is a coating of fine sand or mud on most of the test. One specimen (St. 182) has fine test processes arising from the lower part of the body, as in the type specimen. The largest specimen is only 15 mm. in length, as compared with 20 mm. in Ärnbäck's material, and 30 mm. in Kott's material.



Text-fig. 31. *Caenagnesia bocki* Ärnbäck (St. 42): A, specimen with test removed; B, dorsal tubercle.

Internal structure. The 'Discovery' specimens show remarkable agreement with Ärnbäck's detailed account. The numerous oral tentacles are arranged in five distinct circles. The rectum appears to be a little shorter than that shown in Ärnbäck's fig. 20.

Remarks. This species has been recorded only twice before; off Graham Land (Ärnbäck, 1938), and off Enderby Land (Kott, 1954) if we accept *Agnesia complicata* Kott as a synonym of *C. bocki*. Kott's description of the specimens which she examined from near Enderby Land agrees very closely with Ärnbäck's description of the type specimens, except in having a better developed branchial sac. In *A. complicata* there were twenty-four transverse rows of infundibula each with seventeen infundibula, as compared with twelve rows each with thirteen or fourteen infundibula in *C. bocki*. This difference can be accounted for by the larger size of the specimens from Enderby Land.

Kott mentioned 'bifid languets' alternating with each transverse row of infundibula and not with each two rows (cf. *A. septentrionalis* Huntsman, *A. glaciata* Michaelsen, van Name, 1945, p. 201). These 'bifid languets' are in fact the bifid papillae which are present on the transverse vessels. True languets, to which Huntsman referred in *A. septentrionalis*, are present only along the roof of the branchial sac. *Caenagnesia*, having a continuous dorsal lamina, has no languets.

Distribution. Antarctic (Graham Land, South Georgia, Enderby Land).

Family CORELLIDAE Lahille, 1887
Subfamily CORELLINAE Herdman, 1882
Genus Corella Alder & Hancock, 1870
Corella eumyota Traustedt

Corella eumyota Traustedt, 1882, pp. 271, 273, pl. 4, figs. 2, 3; pl. 5, figs. 13, 14.
For synonymy see van Name, 1945, p. 212.

OCCURRENCE. St. 55: Falkland Islands, 10–16 m. St. 1652: Ross Sea, 567 m.

REMARKS. I have nothing to add to the descriptions already existing of this well-known species. Van Name (1945) discusses the problems involved in determining the probable synonyms of the species.

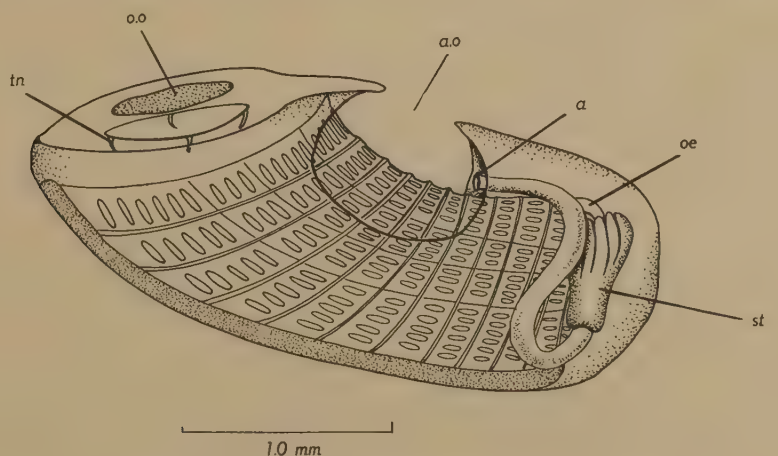
DISTRIBUTION. Antarctic (Graham Land, Kaiser Wilhelm II Land, Ross Sea, ?Wilkes Land), Subantarctic (Falkland Islands, coast of Chile, Magellan region, Auckland Islands, Macquarie Islands), South Africa, St Paul (Indian Ocean), New Zealand (North and South Islands), south and west Australia, Tasmania.

Order *PLEUROGONA* Perrier, 1898
Suborder STOLIDOBRANCHIATA Lahille, 1886
Family STYELIDAE Sluiter, 1895
Subfamily BOTRYLLINAE Adams, 1858
Genus Botryllus Gaertner (in Pallas), 1774
?Botryllus separatus Sluiter (Text-fig. 32)

Botryllus separatus Sluiter, 1904, p. 100, pl. 15, fig. 22.

OCCURRENCE. St. 934: North Island, New Zealand, 98–92 m.

EXTERNAL APPEARANCE. The single example is a brown colony approximately 8·0 by 4·5 cm., soft and thick. There are numerous round, oval or somewhat elongated systems of zooids. Groups of vascular ampullae lie between the systems and also form a fringe round the margin of the colony.



Text-fig. 32. ? *Botryllus separatus* Sluiter (St. 934): Zooid.

ZOOID (Text-fig. 32). The zooids attain a maximum length of 3 mm. and are golden-brown in colour in the preserved state. The oral opening (*o.o.*) is sessile and without lobes, and the atrial opening (*a.o.*) is large, exposing part of the dorsal surface of the branchial sac.

Tentacles. Only four tentacles (*tn.*) were seen, although Sluiter noted eight.

Branchial sac. There are twelve rows of stigmata in most zooids examined, each row with about eighteen stigmata. The three longitudinal branchial bars customary in the genus are present. The dorsal lamina is a narrow membrane.

Gut. The gut is confined to the posterior part of the zooid. It consists of a short curved oesophagus (*oe.*), a conical stomach (*st.*) with nine folds but completely lacking a pyloric caecum, and an S-shaped intestine and rectum. The anus (*a*), which lies opposite the 7th row of stigmata, has a plain margin.

Gonads. No gonads were present in any of the zooids examined.

Remarks. Few species of either *Botryllus* or *Botrylloides* have been described from the North Island of New Zealand or the Australian coasts, and the present specimen does not agree well with any of them. The main points on which I base identification are the absence of a pyloric caecum and the presence of nine folds on the stomach. But there must remain some doubt about this identification because reliable characters are few in the botryllids, and the nearest record of *B. separatus* is from the vicinity of Borneo.

Distribution. Indonesia; North Island, New Zealand.

Genus **Polyzoa** Lesson, 1830

Polyzoa opuntia Lesson (Text-fig. 33A; Pl. V, fig. 1)

Polyzoa opuntia Lesson, 1830, p. 437.
For synonymy see van Name 1945, p. 236.

Occurrence. St. 145: S. Georgia, 26–35 m. St. 1230: Magellan Strait, 27 m. St. 1902: Patagonian Shelf, 50–80 m. St. WS 71: Falkland Islands, 82–80 m. St. WS 75: Falkland Islands, 64–104 m. St. WS 86: Patagonian Shelf, 151–147 m. St. WS 95: Patagonian Shelf, 109–108 m. St. WS 221: Patagonian Shelf, 76–91 m. St. WS 788: Patagonian Shelf: 82–88 m. St. WS 798: Patagonian Shelf, 49–66 m. St. WS 834: Patagonian Shelf, 27–38 m. St. WS 837: Patagonian Shelf, 95–102 m. St. MS 33: S. Georgia, 40 m. St. MS 64: S. Georgia, 7–15 m. St. Port Stanley, Falkland Islands, on shore.

External appearance (Pl. V, fig. 1). The colony of this species, although variable, is well known and characteristic, and needs no further description.

Larva (Text-fig. 33A). The larva has an ovoid trunk measuring about 0·8 mm. from the anterior end of the papillae to the base of the tail. Behind the three papillae is a number of ampullae forming a complete ring round the anterior end of the trunk. There is a single black sense organ. The tail is about 1·5 mm. long, excluding the fin of test which projects about 0·6 mm. beyond the end of the tail.

Biology. Larvae were found in colonies from the Patagonian Shelf and Falkland Islands in December, February, March and June, and in colonies from the Magellan Strait in December. No larvae were present in the colonies from S. Georgia.

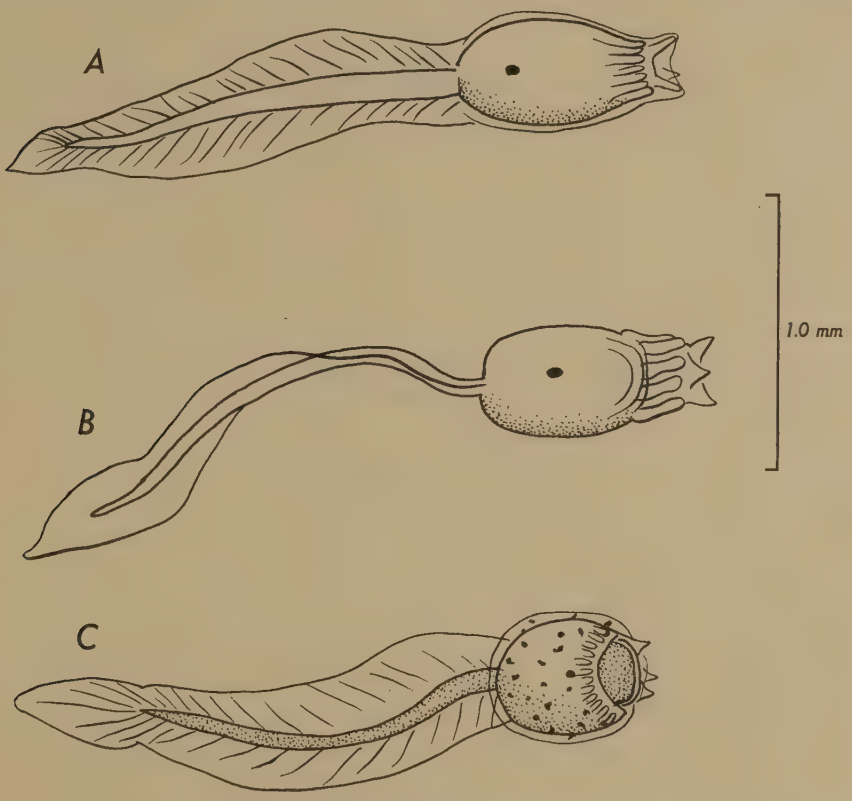
Remarks. Ärnbäck (1950) separated *P. opuntia* Lesson and *P. coccinea* Cunningham, which van Name (1945) regarded as synonymous species. The distinctions which Ärnbäck proposed are: (1) the difference between seven longitudinal bars (*P. opuntia*) and eight bars (*P. coccinea*) on the left branchial wall; and (2) differences in the form of the colony. The colony is very variable and I doubt whether these distinctions are sufficiently great or constant in the genus to justify this course.

Distribution. Subantarctic (coast of Argentine, Falkland Islands, Kerguelen, Tierra del Fuego), Antarctic (South Georgia, Heard Island).

Polyzoa reticulata (Herdman) (Text-fig. 33B; Pl. V, fig. 6)

Chorizocormus reticulatus Herdman, 1886, p. 346, pl. 46, figs. 1–8.
For synonymy see van Name 1945, p. 237.

Occurrence. St. 42: S. Georgia, 120–204 m. St. 51: Falkland Islands, 105–115 m. St. 58: Falkland Islands, 1–2 m. St. 140: S. Georgia, 122–136 m. St. 141: S. Georgia, 17–27 m. St. 148: S. Georgia, 132–148 m. St. 474: S. Georgia, 199 m. St. 1230: Magellan Strait, 27 m. St. WS 25: S. Georgia, 18–27 m. St. WS 27: S. Georgia, 107 m. St. WS 71: Falkland Islands, 80–82 m. St. WS 82: Falkland Islands, 140–144 m. St. WS 85: Falkland Islands, 79 m. St. WS 823: Patagonian Shelf, 80–95 m. St. MS 10: S. Georgia, 26–18 m. St. MS 14: S. Georgia, 190–110 m. St. MS 62: S. Georgia, 31 m. St. MS 71: S. Georgia, 110–60 m. St. MS 74: S. Georgia, 22–40 m.



Text-fig. 33. Larvae of A, *Polyzoa opuntia* Lesson (St. WS 221), B, *P. reticulata* (Herdman) (St. MS 74), and C, *Alloeocarpa incrustans* (Herdman) (St. 388).

External appearance (Pl. V, fig. 6). The colonies vary in form, some having closely united zooids with little or no stolon, and in others the zooids are widely separated with long narrow stolons.

Larva (Text-fig. 33B). In form this is very like the larva of *P. opuntia*. The trunk is from 0·72 to 0·90 mm. long, and the tail from 1·0 to 1·5 mm. excluding the projecting fin of test material. There are three papillae, about fourteen ampullae in a ring round the anterior end of the trunk, and a single black sense organ.

Biology. Larvae were present in colonies collected at Falkland Islands in February and March, and at South Georgia in November, December, February and March.

Distribution. Subantarctic (Falkland Islands, Patagonian Shelf, Magellan Strait, Kerguelen, Campbell Islands, Macquarie Islands), Antarctic (South Georgia).

Genus Alloeocarpa Michaelsen, 1900

Alloeocarpa incrustans (Herdman) (Text-fig. 33C; Pl. V, fig. 8)

Synstyela incrustans Herdman 1886 (in part; not Philippine specimens), p. 342, pl. 46, figs. 9–14.
For synonymy see van Name 1945, p. 239

Occurrence. St. 48: Falkland Islands, 105–115 m. St. 51: Falkland Islands, 105–115 m. St. 52: Falkland Islands, 17 m. St. 55: Falkland Islands, 10–16 m. St. 56: Falkland Islands, 10·5–16 m. St. 58: Falkland Islands, 1–2 m. St. 141: S. Georgia, 17–27 m. St. 145: S. Georgia, 26–35 m. St. 388: Cape Horn, 121 m. St. 474: S. Georgia, 199 m. St. 1230: Magellan Strait, 27 m. St. 1941: S. Georgia, 55–22 m. St. WS 65: S. Georgia, shore collection. St. WS 71: Falkland Islands, 82–80 m. St. WS 84: Falkland Islands, 75–74 m. St. WS 86: Patagonian Shelf, 151–147 m. St. WS 216: Patagonian Shelf, 219–133 m. St. WS 247: Falkland Islands, 172 m. St. WS 765: Patagonian Shelf, 113–119 m. St. MS 6: S. Georgia, 24–30 m. St. MS 10: S. Georgia, 26–18 m. St. MS 33: S. Georgia, 40 m. St. MS 64: S. Georgia, 7–15 m. St. MS 67: S. Georgia, 38 m. St. MS 74: S. Georgia, 22–40 m.

External appearance (Pl. V, fig. 8). Colonies vary from solid fleshy masses with no free space between zooids to forms in which the zooids are separate and united only by a thin basal membrane of test. In the preserved state the colour is brown or grey, but according to the collector's note accompanying colonies from St. WS 765 they may be 'brick red' or 'lemon yellow' in life.

Branchial sac. A number of species, subspecies and forms have been described by various authors, differing mainly in the number of longitudinal branchial bars, and the number and shape of the gonads. After examining many colonies from the 'Discovery' collections I have not found any consistent differences in these characters. For example, Michaelsen (1904) separated two species, *A. zschaui* and *A. incrustans*, by the former having sixteen or seventeen branchial bars and the oviducts wider than long, and the latter having twelve to fourteen bars and the oviducts longer than wide. But in the 'Discovery' collections specimens are found with sixteen bars and the oviducts longer than wide (St. 1941), thus combining characters of both species, and other specimens (St. 58) have an even greater number of bars (twenty-two) together with similar oviducts. There is therefore no reason to separate colonies on the basis of these characters. Van Name (1945) regards *A. zschaui* as identical with *A. incrustans*, but Ärnbäck (1950) allows it the rank of a *form* of *A. incrustans*. A few of the colonies approach Ärnbäck's subspecies, *A. incrustans rugosa*, but in this case also I doubt whether the points of distinction merit the status of a subspecies.

Gonads. In nearly all specimens the testes are confined to the left and the ovaries to the right of the body, but I have found a few in which two or three ovaries are present on the left side, immediately in front of the testes.

Larva (Text-fig. 33C). In shape the larva is very similar to that of *Polyzoa opuntia* and *P. reticulata*. The trunk varies a great deal in size, from 0·34 up to 0·8 mm. and the tail is from 0·9 to 1·2 mm., excluding the fin of test. The great variation in size of the trunk is surprising, but no accompanying differences were found in structure of either the larva or the adult, so the character seems to have little systematic importance in this species. There are the usual three papillae, single black sense organ (only visible on dissection) and ring of anterior ampullae (eighteen to twenty-six in number). The larva is red-brown in the preserved state. In some larvae there are distinct pigment spots on the surface of the trunk, and these appear to be produced by pigment cells within the test.

Biology. The presence or absence of larvae in the colonies of the collection is shown in Table 30. The numbers are small, but it is evident that breeding is not confined to a short season, although it probably occurs chiefly in the months of January to May, i.e. southern summer and autumn.

Larvae were found in the colonies from the Patagonian Shelf and Falkland Islands in February, March, April, May and June, and in colonies from South Georgia in November, January and February.

DISTRIBUTION. Subantarctic (Falkland Islands to Tierra del Fuego), Antarctic (South Georgia).

Table 30

	V	*VI*	*VII*	*VIII*	*IX*	*X*	*XI*	*XII*	*I*	*II*	*III*	*IV*
No. of colonies with larvae	3	1	0	—	—	0	1	0	2	1	1	2
No. of colonies without larvae	4	0	1	—	—	1	0	2	1	4	1	0

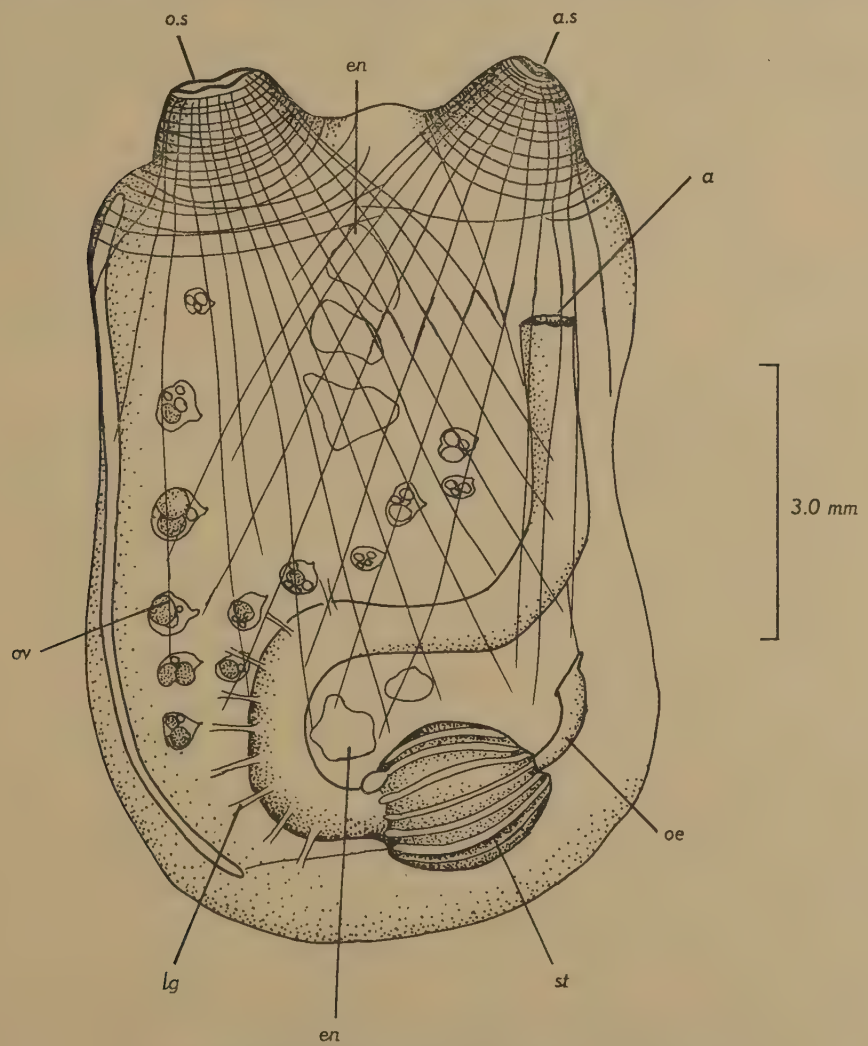
Genus **Amphicarpa** Michaelsen, 1922

Amphicarpa diptycha (Hartmeyer) (Text-fig. 34, Pl. V, fig. 3)

Distomus diptychos Hartmeyer, 1919, p. 87, pl. 2, fig. 48.

OCCURRENCE. St. 1686: Victoria, Australia, 0 m.

EXTERNAL APPEARANCE (Pl. V, fig. 3). The colony, which is about 5 cm. long, and rather less in width, had been growing on the shell of a living mussel. For the most part the zooids are close



Text-fig. 34. *Amphicarpa diptycha* (Hartmeyer) (St. 1686): Zooid.

together, only those on the margins of the colony lying some distance apart. Where the zooids are separated the narrow basal stolons which unite them can be seen. Sand almost completely covers both zooids and stolons. The zooids are ovoid, upright, may be slightly narrowed at the base, and bear the two inconspicuous siphons at the upper end. The largest zooids are about 1 cm. long.

Tentacles. The oral tentacles, although closely spaced, number only about 50, whereas Kott (1952) found about 100.

Dorsal tubercle. The opening of the dorsal tubercle is a simple longitudinal slit.

Branchial sac. In a large zooid the longitudinal branchial bars have the following arrangement: dorsal line 0 (12) 5 (9) 6 endostyle.

Gut. The gut is just as Kott described it, including the series of ligaments (Text-fig. 34, *lg.*) attached to the intestine.

Gonads. Only the ovaries are present in zooids of the 'Discovery' colony, there being no trace of testes. On the right side there is a slightly curved row of about eight very small ovaries; on the left side two rows diverge from the postero-ventral part of the body wall, one parallel to the endostyle and the other following the course of the intestine (*ov.*).

Endocarps. Large and small endocarps (*en.*) are scattered over much of the body wall.

Distribution. Western and southern coasts of Australia; Tasmania.

Subfamily Styelinae Herdman, 1881

Genus Cnemidocarpa Huntsman, 1913

Cnemidocarpa pfefferi (Michaelsen) (Text-figs. 35 A–C)

Styela pfefferi Michaelsen, 1898, p. 367.

Occurrence. St. 42: S. Georgia, 120–204 m. St. 123: S. Georgia, 230–250 m. St. 159: S. Georgia, 160 m. St. 1952: S. Shetlands, 367–383 m.

External appearance. The largest specimen is 5·2 cm. high and 2·5 cm. wide, and the smallest one 2·2 by 2·2 cm. The body is generally upright with the two quite prominent siphons a little distance apart at the upper end. Shallow furrows divide the surface into large irregular areas. All the examples in the 'Discovery' collection are pale grey in the preserved state, with a fairly smooth surface which is almost free of encrusting matter.

Tentacles. These vary from ten to thirty-two according to the size of the specimen.

Dorsal tubercle. The dorsal tubercle of the 'Discovery' specimens is constant in form, having a C-shaped slit with inrolled horns and the open interval facing forward.

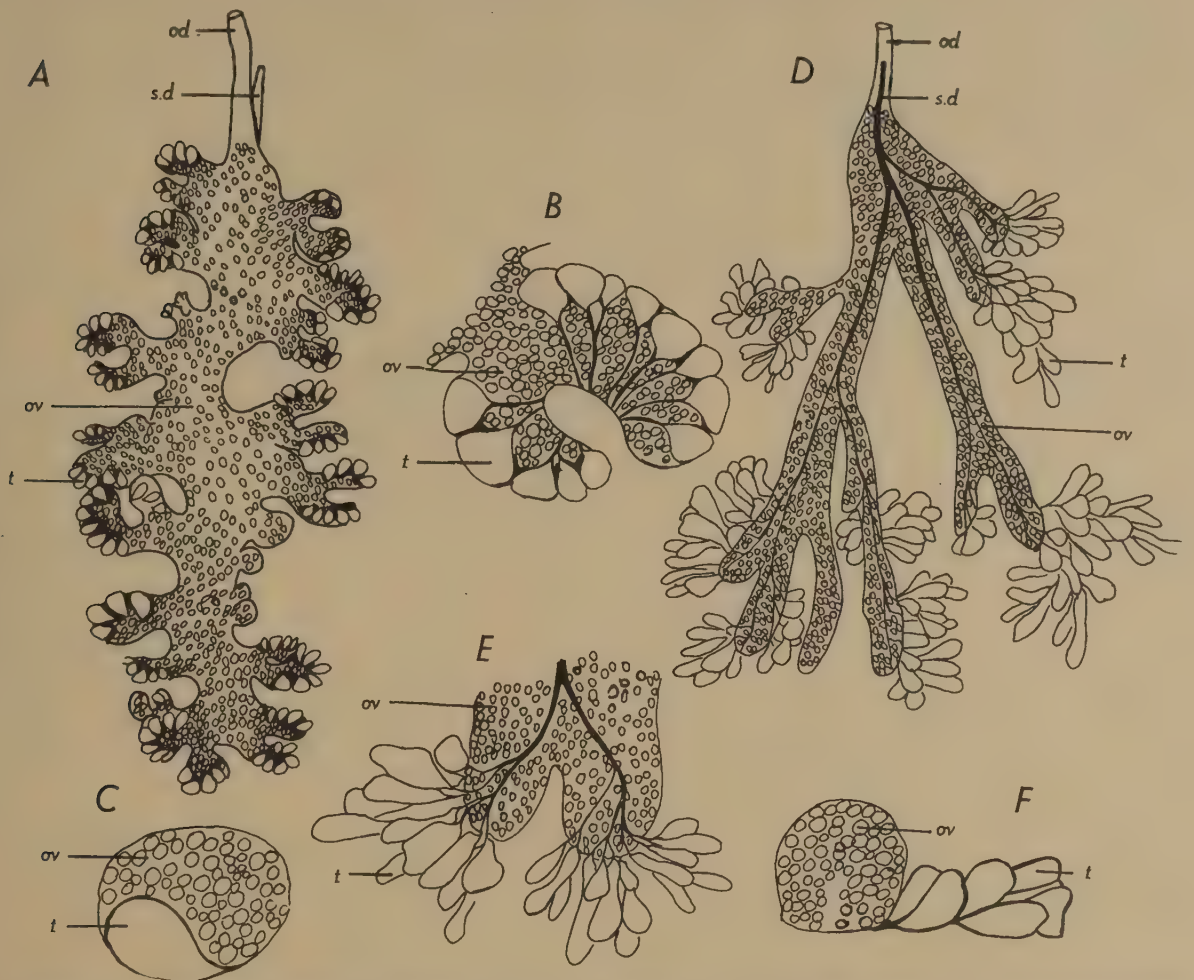
Gut. The stomach has twenty-four to thirty-one complete folds.

Gonads (Text-figs. 35 A, B, C). In all specimens dissected there were two gonads on each side. Each consists of a sinuous ovary (*ov.*), the sides of which have swellings, knobs, or short branches. These short lateral branches are generally in pairs with the two limbs curved in towards each other. The testis follicles (*t*) are arranged on the sides of the branches in a very characteristic manner (see Text-fig. 35 B) and are closely united to the ovarian branches from the sides of which they scarcely project even when well developed. The gonad is therefore of the *Cnemidocarpa* type, in which the testis is bound closely to the ovary, within a common membrane.

Remarks. This species has been confused with *Styela paessleri*, and van Name (1945) considered them to be probably identical. The structure of the gonads is, however, quite different, although when *S. paessleri* is at full maturity the testis is so large that it presses closely round the sides of the ovary (see p. 115). The difference in the gonads of the two species will be best understood by reference to

Text-figs. 35A–C and D–F which show the close union of testis and ovary in *C. pfefferi* and their separation in *S. paessleri*.

DISTRIBUTION. Antarctic (South Georgia, South Shetland Islands).



Text-fig. 35. *Cnemidocarpa pfefferi* (Michaelsen) (St. 123): A, gonad; B, lobe of gonad enlarged; C, transverse section of lobe of gonad. *Styela paessleri* Michaelsen (St. 53): D, gonad; E, part of gonad enlarged; F, transverse section of part of gonad.

Cnemidocarpa nordenskjöldi (Michaelsen) (Text-figs. 36A, C, D)

Styela nordenskjöldi Michaelsen, 1898, p. 365.

OCCURRENCE. St. 53: Falkland Islands, 0–2 m. St. WS 71: Falkland Islands, 82–80 m. St. WS 94: Patagonian Shelf, 110–126 m. St. WS 221: Patagonian Shelf, 76–91 m. St. WS 243: Patagonian Shelf, 144–141 m. St. WS 247: Falkland Islands, 172 m. St. WS 582: Magellan Strait, 12 m. St. WS 583: Magellan Strait, 14–78 m. St. WS 784: Patagonian Shelf, 170–164 m. St. WS 805: Patagonian Shelf, 148–150 m. St. WS 847: Patagonian Shelf, 51–57 m.

EXTERNAL APPEARANCE. The many specimens range from very young ones, little over 1 mm. in length, to a large one 5 cm. long and 2·6 cm. high. They are variable in shape, either ovoid, almost globular or low with an expanded base. The siphons are not very far apart and may be quite prominent or rather small. Small mammillations break up the surface of the test, giving it a slightly rough

appearance. Although preserved specimens are brown, a collector's note describes one specimen as 'orange' in life.

INTERNAL STRUCTURE. The anatomy of the species has already been described in detail, particularly by Michaelsen (1900), van Name (1945) and Ärnbäck (1950). The specimens in the 'Discovery' collections are in close agreement with these accounts. But three specimens from the Palmer Archipelago which I have assigned to the closely related *C. drygalskii* (Hartmeyer) require that these species be compared, particularly as van Name (1945) considered them to be possibly synonymous. In Table 31 I have shown their main characters, including those of 'Discovery' specimens.

Table 31

	C. nordenskjöldi		*C. drygalskii*	
	Michaelsen (1900)	'Discovery' specimens	Hartmeyer (1911)	'Discovery' specimens
Tentacles	About 44	28–36	30–40	26–35
Dorsal tubercle	C-shaped or closed ring	C-shaped	Half-moon or ring-shaped	C-shaped
Branchial folds	10–12 bars per fold; 4–6 bars between folds	10–20 bars per fold; 4–14 bars between folds	8–20 or more bars per fold; 4–6 bars between folds	5–20 bars per fold; 3–10 bars between folds
Parastigmatic bars	Present in places	Present	Present	Present
Dorsal lamina	A few irregular teeth	Smooth	Smooth	Smooth
Stomach folds	About 21	20–26	About 14	12–15
Intestinal loop	Crosses endostyle	Crosses endostyle, except in very small specimens	Does not cross endostyle	Does not cross endostyle
Anus	3 lips each subdivided	2 or 3 lips, more or less subdivided	2 lips; smooth margin	2 or 3 lips, more or less subdivided
Gonads	One on each side; testis follicles closely bound to ovary	One on each side; testis follicles closely bound to ovary	One on right, one or two on left; testis follicles closely bound to ovary	One on each side; testis follicles closely bound to ovary

It appears from the comparison that only two characters separate the species: (1) the number of folds on the wall of the stomach; and (2) whether or not the intestinal loops cross the endostyle into the right half of the body (Text-fig. 36A, B).

The number of folds on the stomach seems to be a valid distinguishing character, as shown by the following comparison of 'Discovery' specimens of approximately the same size:

	C. nordenskjöldi			*C. drygalskii*		
Body length (cm.)	1·3	1·8	2·1	1·5	2·3	2·5
No. of folds on stomach	20	24	26	12	12	15

The course of the intestinal loop is also generally a reliable character and only breaks down in young specimens of *C. nordenskjöldi*, in which the loop has not yet grown across the endostyle to the right side of the body.

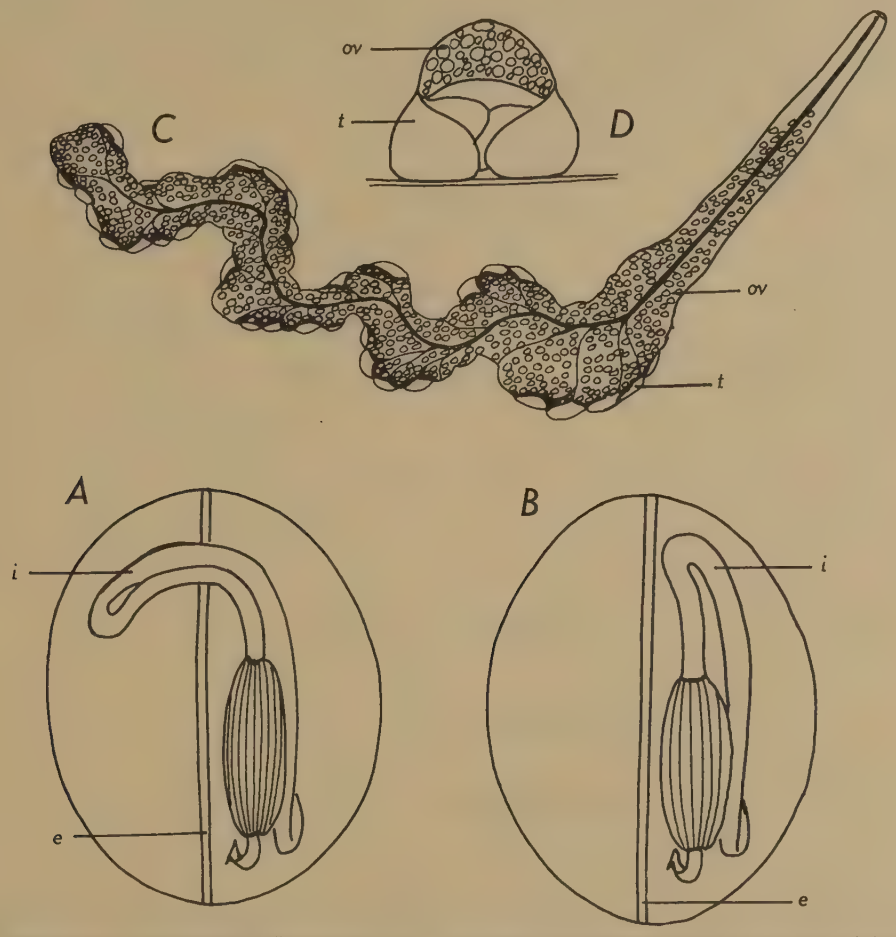
The two species also differ in distribution, *C. nordenskjöldi* being confined to the Subantarctic and *C. drygalskii* to the Antarctic.

GONADS. *Cnemidocarpa* and *Styela* are distinguished from each other mainly by differences in the structure of their gonads. That these distinctions are not entirely satisfactory is shown by *C. nordenskjöldi*. In this species the testis follicles are closely applied to the sides and parietal surface of the gonad and are enclosed along with the ovary within a common membrane (Fig. 36C, D), thus agreeing with the condition in *Cnemidocarpa* (see van Name, 1945, pp. 262–3). When the testis is fully developed,

however, the follicles project slightly from the sides of the gonad, which then approaches the condition typical of *Styela*. In fact van Name (1945) placed the species in *Styela*, but pointed out that 'the gonads approach the *Cnemidocarpa* type'. Ärnbäck (1950), however, suggested that the species should be placed in her genus *Ypsilocarpa*, which, she says, 'agrees with the genus *Cnemidocarpa* as regards the general structure of the reproductive organs, the ovary and testis not being separated'.

The genus *Ypsilocarpa* (Ärnbäck, 1921) was characterized as follows:

'*Branchial sac.* Four folds on each side; three are well developed, and one—the second—is in a rudimentary state.



Text-fig. 36. *Cnemidocarpa nordenskjöldi* (Michaelsen) and *C. drygalskii* (Hartmeyer): A, B, comparison of the intestinal loop, ventral view; C, gonad of *C. nordenskjöldi* (St. WS 805); D, transverse section of the same.

Gonads. One elongate cylindrical gonad on each side, bent into the shape of the letter U, and made up of both ovary and testis.

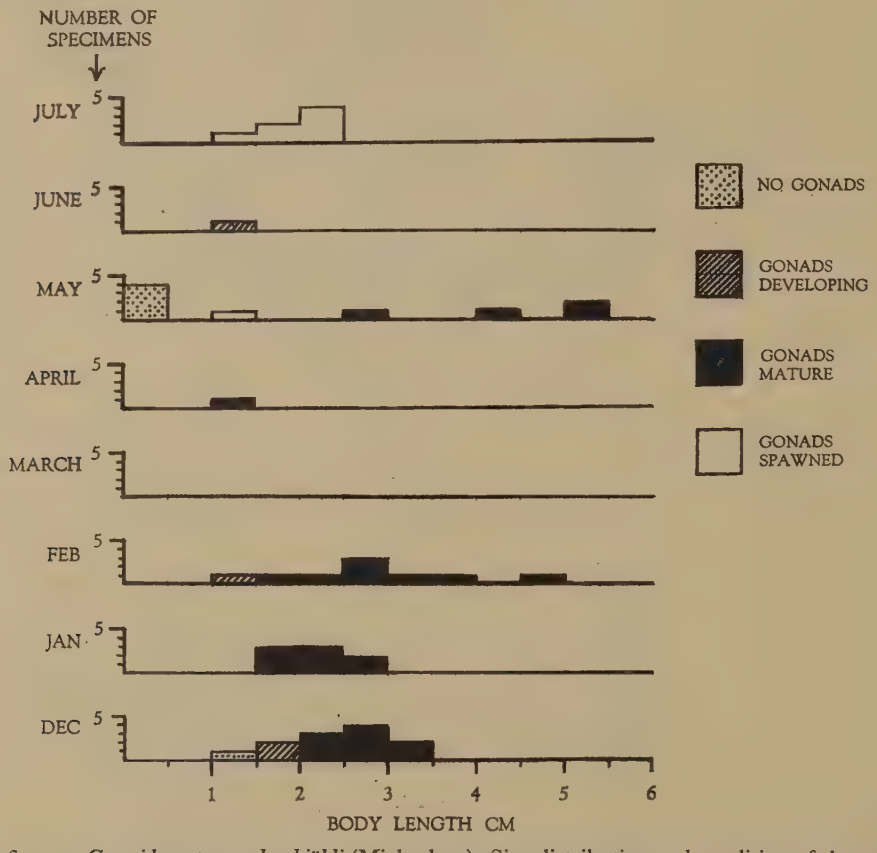
Atrial tentacles. The atrial tentacles are thickly scattered over the narrow velum.'

Ärnbäck evidently regarded the gonads and the atrial tentacles as the best characters for separating *Ypsilocarpa* from *Cnemidocarpa*, but as mentioned above found the structure of the gonad basically similar. There remains only the number of the gonads, their considerable length, and their shape, together with the distribution of the atrial tentacles, to distinguish the two genera, but I do not consider that these characters, even in combination, are of generic value. The proper genus for *nordenskjöldi* is therefore thought to be *Cnemidocarpa*.

Biology. In Text-fig. 37 are shown the size-distribution and state of the gonads in all specimens, adding together all material from different years.

Only large specimens were present in December, January, February and April. Material collected in May shows a number of very small specimens representing the new generation. The breeding season probably occurs between the end of February and the beginning of May. This is confirmed by the state of the gonads which are full from December until February in those animals large enough to be mature. In July animals of a similar size have empty gonads, showing that these animals have spawned.

Distribution. Subantarctic (Falkland Islands to Tierra del Fuego).



Text-fig. 37. *Cnemidocarpa nordenskjöldi* (Michaelsen): Size distribution and condition of the gonads of specimens collected in different months.

Cnemidocarpa drygalskii (Hartmeyer) (Text-fig. 36 B)

Styela drygalskii Hartmeyer, 1911, p. 452, pl. 45, fig. 6, pl. 50, figs. 6–10.

Occurrence. St. 187: Palmer Archipelago, 259–354 m.

External appearance. The body is dorso-ventrally flattened into a low dome-shape, with a broad base of attachment. A roughened surface is produced by the presence of many small raised plates on the test. The colour is pale brown.

Internal structure. The diagnostic characters of the species, and details of the 'Discovery' specimens, have been given in the comparison with *Cnemidocarpa nordenskjöldi* (see Table 31).

Remarks. I believe that this species, like the previous one, is best placed in the genus *Cnemidocarpa*,

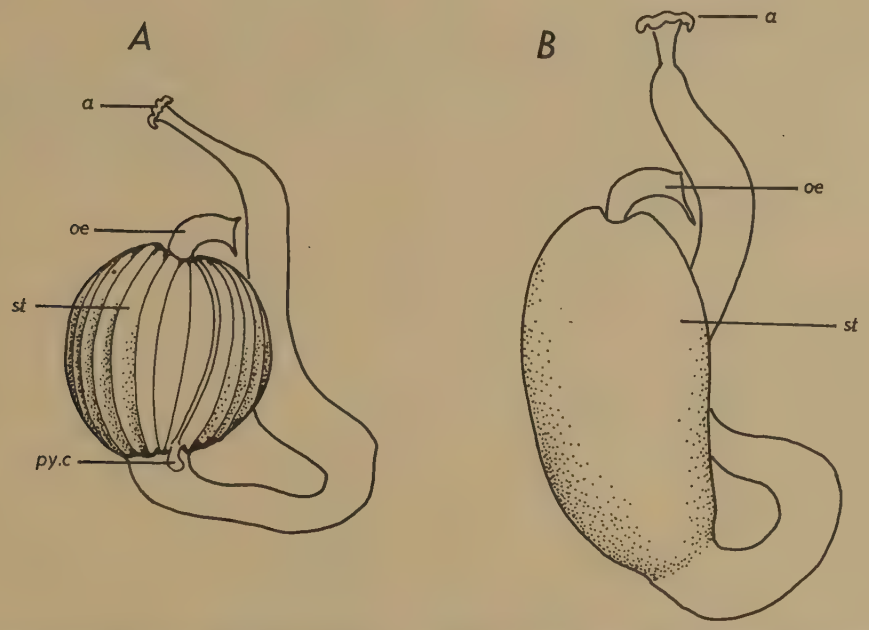
and for the same reasons relating to the structure of the gonad which is similar in both species (see p. 102).

DISTRIBUTION. Antarctic (Graham Land; Kaiser Wilhelm II Land).

Cnemidocarpa verrucosa (Lesson) (Text-fig. 38; Pl. V, fig. 5)

Cynthia verrucosa Lesson, 1830, p. 151, pl. 53, fig. 2.
For synonymy see van Name 1945, p. 272.

OCCURRENCE. St. 39: S. Georgia, 179–235 m. St. 42: S. Georgia, 120–204 m. St. 45: S. Georgia, 238–270 m. St. 51: Falkland Islands, 105–115 m. St. 53: Falkland Islands, 0–2 m. St. 55: Falkland Islands, 10–16 m. St. 58: Falkland Islands, 1–2 m. St. 123: S. Georgia, 230–250 m. St. 140: S. Georgia, 122–136 m. St. 143: S. Georgia, 273 m. St. 148: S. Georgia, 132–148 m. St. 159: S. Georgia, 160 m. St. 160: S. Georgia, 177 m. St. 190: Palmer Archipelago, 93–126 m. and 315 m.



Text-fig. 38. *Cnemidocarpa verrucosa* (Lesson) (St. 366): A, gut of specimen 0·4 cm. long; B, gut of specimen 4·0 cm. long.

St. 366: S. Sandwich Islands, 332–155 m. St. 370: S. Sandwich Islands, 80–18 m. St. 371: S. Sandwich Islands, 99–161 m. St. 474: S. Georgia, 199 m. St. 599: S. Shetlands, 203 m. St. 1159: between Bouvet Island and Crozet Island, 230–0 m. St. 1952: S. Shetlands, 367–383 m. St. WS 25: S. Georgia, 18–27 m. St. WS 71: Falkland Islands, 82–80 m. St. WS 81: Falkland Islands, 81–82 m. St. WS 85: Falkland Islands, 79 m. St. WS 823: Patagonian Shelf, 80–95 m. St. MS 68: S. Georgia, 220–247 m. St. MS 71: S. Georgia, 110–60 m. British Graham Land Expedition, 1934–7: St. Stella Creek, 10 m.

EXTERNAL APPEARANCE (Pl. V, fig. 5). The appearance of this species is well known and characteristic (see van Name, 1945, p. 272). The largest specimen in the collection has a length of 16 cm. and a breadth of 6·7 cm.

BRANCHIAL SAC. In large individuals the wall of the branchial sac is minutely plicate with the folds running parallel to the longitudinal bars.

GUT. Hartmeyer (1911) found a small pyloric caecum in young specimens, although there is none in large ones. This is confirmed by examination of the 'Discovery' material; specimens of greatest

diameter about 0·4 cm. possess a small caecum (Text-fig. 38A, *p.c.*), but all specimens over about 2·0 cm. in diameter lack a caecum (Text-fig. 38B). There are about twenty-four folds on the wall of the stomach, but they are internal and are visible from the outside only in small specimens (see Text-fig. 38A, B).

Biology. Text-fig. 39 shows the size-distribution, in different months, of the specimens from two collecting areas: (1) the Falkland Islands and Patagonian Shelf; and (2) South Georgia, the South Shetland Islands, the South Sandwich Islands and Graham Land. In both populations breeding had probably started before March, as indicated by the presence of young individuals in that month. In the more southerly localities no very young specimens were taken in April, but it must be pointed out that the total numbers collected at this time were very small. The samples from the Falkland Islands and Patagonian Shelf, taken in May, include quite a high proportion of young individuals, suggesting a breeding season extending farther into the southern autumn in the Subantarctic population, than in the Antarctic population.

The histograms for March (Antarctic) and May (Subantarctic) point to the presence of at least two year-classes, and the animals may possibly live for two years or more. These are only very tentative suggestions, however, as the numbers of specimens are small and the months of collection limited.

Distribution. Subantarctic (Falkland Islands, Patagonian Shelf, Kerguelen); Antarctic (Graham Land, Kaiser Wilhelm II Land, South Georgia, South Shetland Islands, South Sandwich Islands, Enderby Land, Queen Mary Land, MacRobertson Land).

Cnemidocarpa tricostata sp.n. (Text-fig. 40)

Diagnosis of species. Ventral half of body with a thick coat of test hairs, dorsal half without hairs. About twenty-two oral tentacles, and a single circle of atrial tentacles. Dorsal tubercle with a straight opening. Branchial sac without folds, but with three longitudinal bars on each side. Stomach with about thirteen folds. One gonad on the left side and none on the right.

Occurrence. St. 27: S. Georgia, 110 m.

External appearance (Text-fig. 40A). The single specimen is 1·2 cm. high and 0·9 cm. across at the widest point. In the preserved state it is pear-shaped with a swollen base which apparently rested on a soft substratum. The upper part of the body narrows towards the siphons which are close together and project as short tubular papillae with 4-cleft openings. The test on the upper half of the body is broken up into rounded wart-like swellings, which in some places have the appearance of being arranged in circles passing round the body. No test hairs or foreign particles are present on the upper part of the body, which is yellowish grey in colour. The lower half bears a thick coat of test hairs to which a few sand grains adhere. These hairs are unbranched and not very long. They arise either singly or in groups of two or three.

Test. The test is rather thin but tough.

Body wall. The muscles of the body wall are arranged in two layers, an external one of weak circular muscles and an internal one of strong longitudinal muscles. A few large clear endocarps are attached to the inner surface of the body wall.

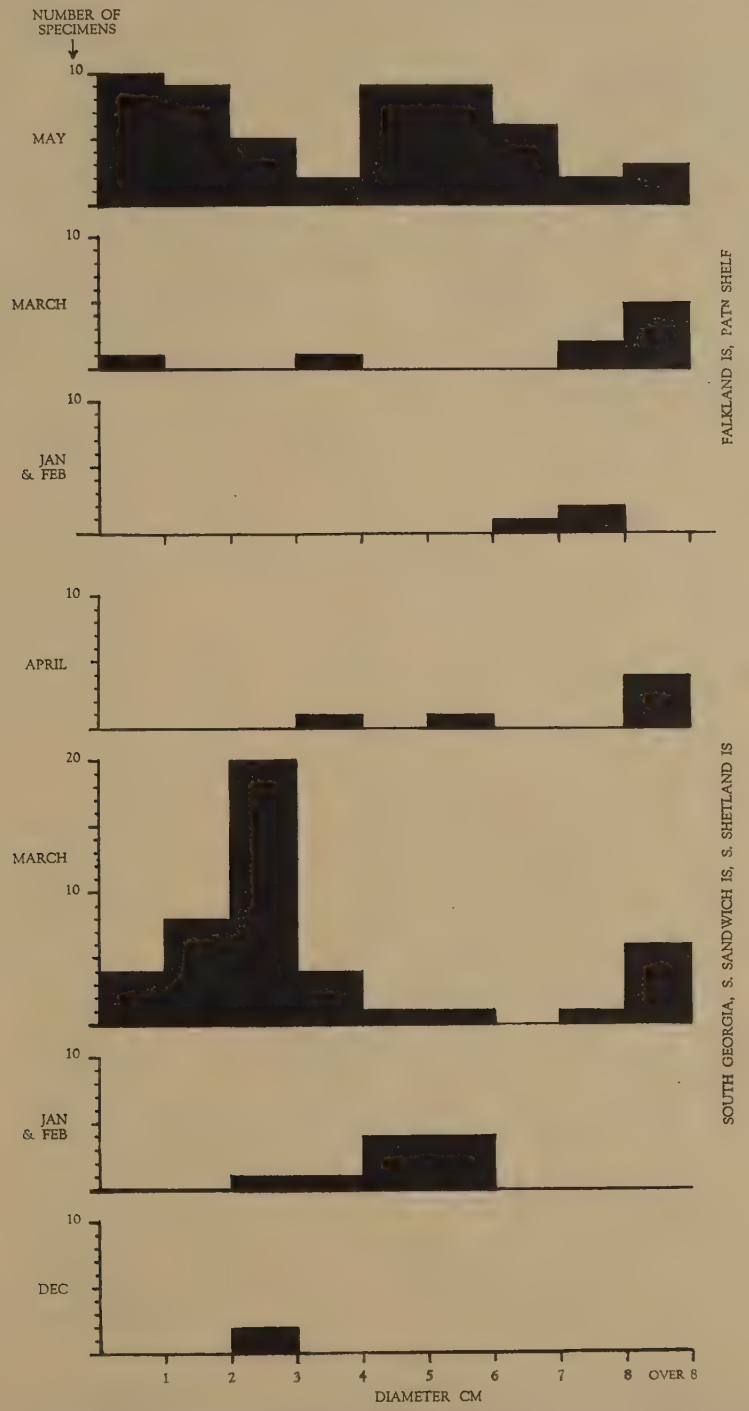
Tentacles. There are about twenty-two simple oral tentacles and a single circle of many slender atrial tentacles.

Dorsal tubercle. The dorsal tubercle is rather small, with a simple oval transverse opening (Text-fig. 40D).

Branchial sac. There are no folds on the branchial walls, each side having only three tall longitudinal bars (Text-fig. 40C, *l.b.*). The meshes are therefore long, and each accommodates up to thirty stigmata (Text-fig. 40E). Slender parastigmatic transverse bars pass across the centres of the rows

of stigmata. At the anterior end of the branchial sac the dorsal lamina (*d.la.*) is narrow, and it increases gradually in width towards the oesophageal mouth; the margin is plain and slightly rolled in.

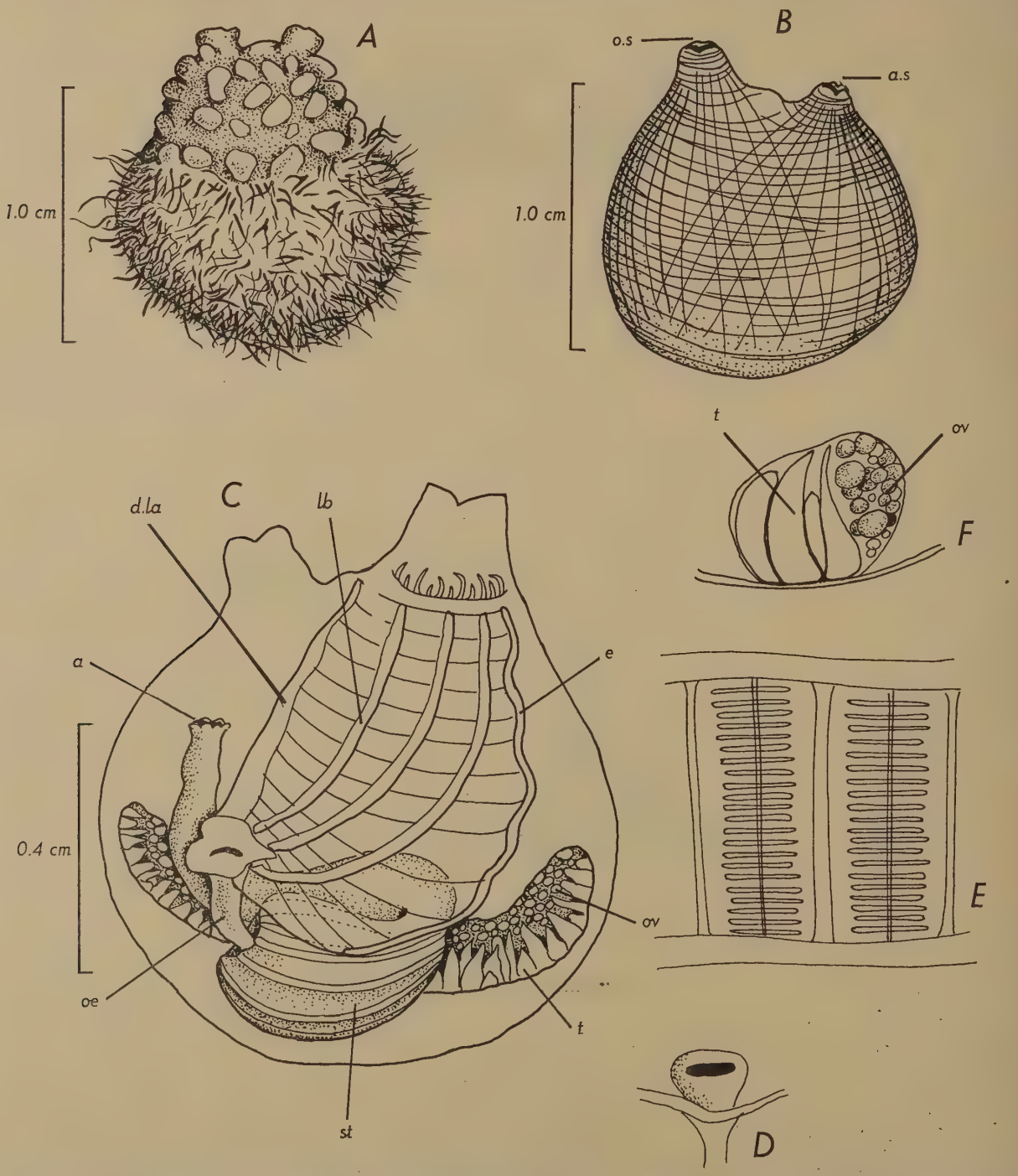
GUT. The oesophagus (*oe.*) is short, curved and rather wide. About thirteen longitudinal folds mark the walls of the large ovoid stomach (*st.*). A very small straight pyloric caecum is hidden in the bend



Text-fig. 39. *Cnemidocarpa verrucosa* (Lesson): Size-distribution of specimens collected from different areas and in different months.

between the stomach and the intestine. The intestine bends sharply back after leaving the stomach, lies close to the left side of the stomach, then bends forwards near the oesophagus. The rectum is of moderate length and ends in a wide anus (*a.*) with about twelve shallow lobes.

GONAD (Text-fig. 40C, F). Only a single gonad was found in this specimen, and that is on the



Text-fig. 40. *Cnemidocarpa tricostata* sp.n. (St. 27): A, external appearance; B, specimen with test removed; C, specimen with right half of the body removed, seen from the right; D, dorsal tubercle; E, part of branchial wall; F, transverse section of gonad.

left side. The gonad starts ventrally a little to the right of the endostyle, and curves across the posterior half of the left side of the body to end rather far back in the atrial cavity. In structure the gonad is of the typical *Cnemidocarpa*-type, with the testis (*t*) occupying that part of the gonad which is attached to the body wall, and the ovary (*ov.*) on the free or mesial side. The testis consists of long narrow follicles arranged in a series along the length of the gonad. The ovary occupies the superficial part of the gonad and shows oocytes of various sizes. No oviduct could be seen. Two short slender sperm ducts were found along the length of the gonad, projecting from its free (ovarian) surface.

Remarks. This is a very distinctive species not readily confused with any *Cnemidocarpa* yet described. In the formation of the branchial sac it is most like *Styela insinuosa* (Sluiter), but in having only three bars on each side shows a still greater simplification. A few species of *Cnemidocarpa* and *Styela* have a reduced number of branchial folds. Thus in *C. mortenseni* (Hartmeyer) there is only one on each side, and in the deep-sea species *S. sericata* Herdman there are no folds but twenty to thirty longitudinal bars on each side.

The presence of only one gonad in *C. tricostata* is also a remarkable case of simplification.

Distribution. Antarctic (South Georgia).

Genus Styela Fleming, 1822

Styela schmitti van Name f. simplex n. (Text-fig. 41)

Styela schmitti van Name, 1945, p. 298, text-fig. 195.

Diagnosis of form *simplex*. Characters as in the species but with about eight tentacles, a simple slit-like opening of the dorsal tubercle, and only one well-developed fold and a rudimentary one on each side of the branchial sac.

Occurrence. St. 388: off Cape Horn, Tierra del Fuego, 121 m.

External appearance (Fig. 41 A–C). The shape of the body is much as described by van Name (1945) except that it is generally rather narrower and more nearly cylindrical. The sizes of the body and stalk in the 'Discovery' specimens are:

Body length (mm.)	7	7	5	5	5	5
Stalk length (mm.)	4	3	3	3	2	1

A light coating of sand and broken shell covers the body of all the specimens, but does not extend to the stalk. Two small projections close together at the upper end of the body mark the scarcely visible siphons.

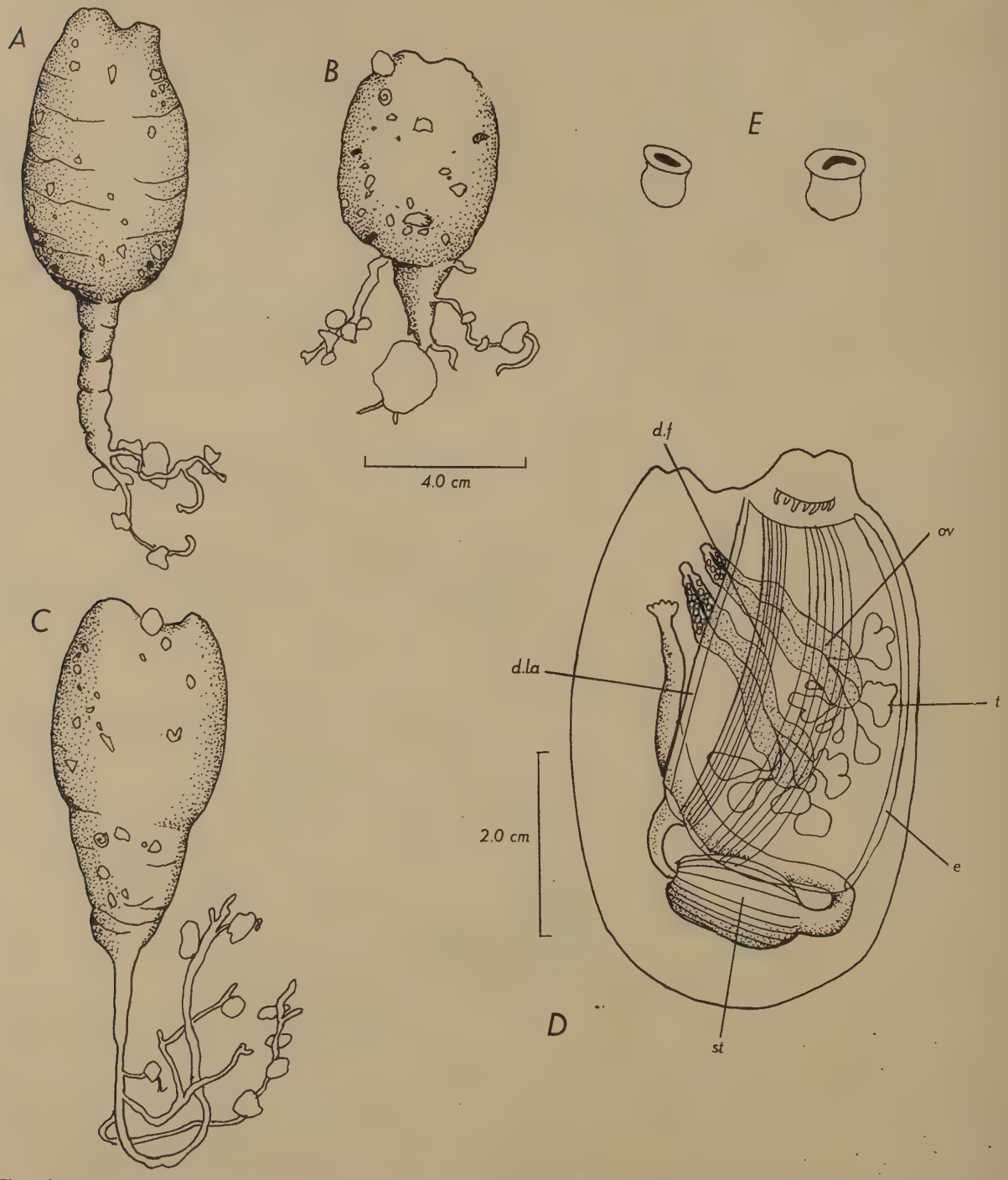
Internal structure (Text-fig. 41 D). The main internal characters of the form *simplex* are shown in Table 32 along with those of van Name's type material of the species.

Table 32

	S. schmitti f. *simplex* ('Discovery' material)	*S. schmitti* (type material, van Name)
Body-wall muscles	External circular and internal longitudinal muscles forming sheets of fine strands	Diffuse
Tentacles	8–16; short	Probably 35–40
Dorsal tubercle	Simple transverse slit	Modified C-shaped slit, with open interval to left
Branchial folds	Well-developed dorsal fold, rudimentary second fold, other folds absent	4 folds, dorsal one highest, ventral one sometimes reduced
No. of stomach folds	About 20	About 20
Anus	2 simple or slightly frilled lobes	A number of deep rounded lobes
Gonads	2 each side; ovaries tubular; testes grouped round blind ends of ovaries	Normally 2 each side; ovaries elongate sinuous; testes along both sides and round blind ends of ovaries
Occurrence	Off Tierra del Fuego; 121 m.	Off Montevideo, Uruguay; about 21 m.

In the branchial sac only the dorsal fold is present on each side and a second one is represented merely by the closer spacing of some of the longitudinal bars. The arrangement of the bars on one side in a large specimen was: dorsal line 4 (6) 3 (6) 3 endostyle.

It will be seen from the above table that f. *simplex* is principally distinguished from the type material



Text-fig. 41. *Styela schmitti* van Name f. *simplex* n. (St. 388): A, B, C, external appearance of three specimens; D, specimen with right side of the body removed, seen from the right; E, dorsal tubercle of two specimens.

by: (1) the smaller number of tentacles; (2) the simpler dorsal tubercle; and (3) the greater reduction of the branchial folds.

The similarities between the 'Discovery' specimens and those described by van Name are too great to justify specific distinction. The degree of distinctness is best indicated, I believe, by a separate form, f. *simplex*, the name referring to the tendency towards simplification in several organs.

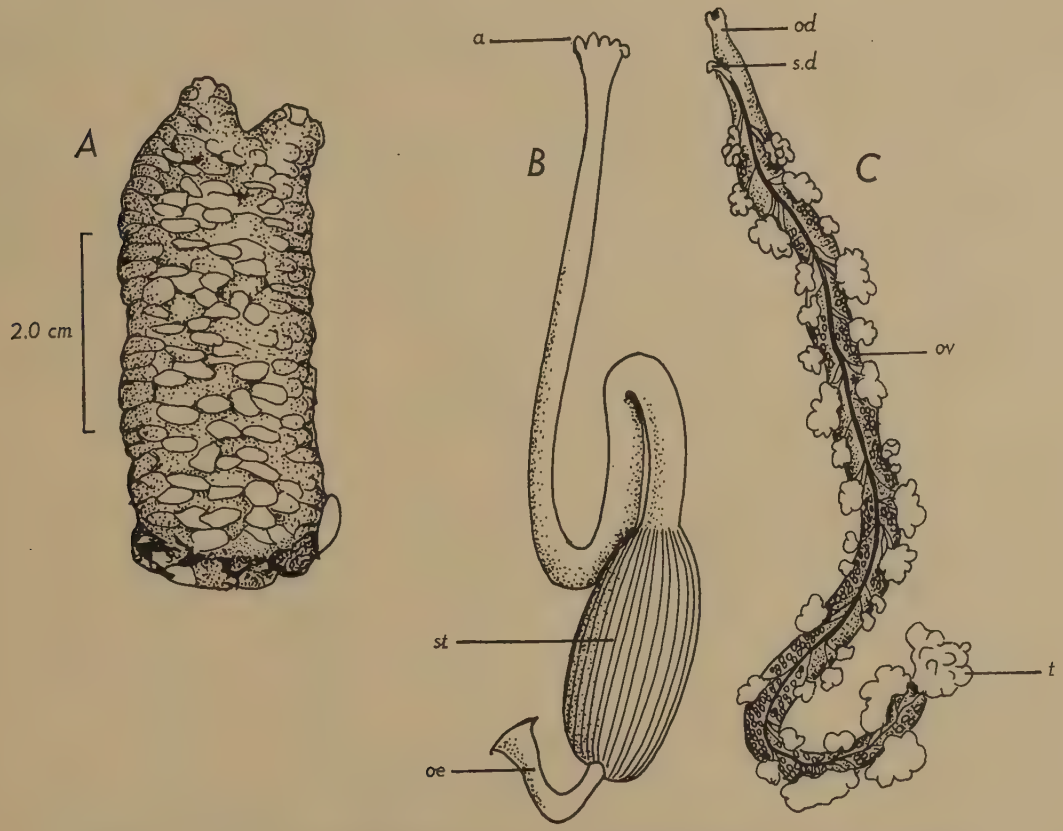
DISTRIBUTION. Off Uruguay (typical form); off Cape Horn, Tierra del Fuego (f. *simplex*).

Styela insinuosa (Sluiter) (Text-fig. 42)

Tethyum insinuosum Sluiter, 1912, p. 24, pl. 2, figs. 28–32; pl. 3, figs. 33–35; pl. 4, fig. 44.

OCCURRENCE. St. 156: S. Georgia, 200–236 m. St. 474: S. Georgia, 199 m.

EXTERNAL APPEARANCE (Text-fig. 42A). The specimens are all more or less cylindrical, with the siphons fairly close together at the upper end. The whole surface is covered with low wart-like swellings, and the colour in the preserved state is brown. The largest specimen is 5·3 cm. high by 2·0 cm. wide, and the smallest is 2·2 cm. by 1·5 cm.



Text-fig. 42. *Styela insinuosa* (Sluiter) (St. 474): A, external appearance; B, gut; C, left gonad.

BODY WALL. The body wall is quite thick, owing to the existence of powerful muscles which constitute an inner longitudinal, a middle circular, and an outer longitudinal layer.

TENTACLES. There are twenty-four oral tentacles in the largest animal and about sixteen in the smallest; Sluiter (1914) found up to thirty-two. The atrial tentacles are numerous and stand in a single circle on the margin of a low velum within the atrial siphon.

DORSAL TUBERCLE. The slit of the dorsal tubercle is C-shaped with inrolled horns, the open interval facing forward.

Branchial sac. The complete absence of branchial folds constitutes the most remarkable and characteristic feature of the species. There are only four large longitudinal bars on each side of the branchial sac. Plication of the branchial wall increases the surface area, as it does in several species of *Ascidia*.

Gut (Text-fig. 42B). Sluiter has already described the course of the gut, noting the longitudinal position of the stomach and double intestinal loop. All the 'Discovery' specimens confirm his description, but I find more folds on the wall of the stomach, about thirty-five even in a small specimen instead of the twenty which he found, and the stomach sometimes lies obliquely or almost vertically. The margin of the anus has about twelve distinct lobes.

Gonads. In the type specimens Sluiter described one gonad on the left and two on the right, but Kott (1954) found only one on each side. In the 'Discovery' material also there is a single gonad on each side. The anterior part of each ovary (Text-fig. 42C, *ov.*) is straight and the posterior part variously bent. In the largest specimen the right gonad is distinctly curved upwards to form a U with unequal limbs. Groups of testis follicles (*t*) are situated along the length of the ovaries, but are more plentiful at their posterior ends and are sometimes confined to this region.

Remarks. This is a species which has seldom been taken by expeditions, only Sluiter and Kott having examined material so far as I know.

Very few styelid ascidians, other than compound forms, have carried the reduction of branchial folds, and even branchial bars, so far. I would point to the similarity between the present species and the Arctic styelid species *Pelonaia corrugata* Goodsir & Forbes, which also has flat branchial walls. The form of the gonads is another point of similarity, particularly in the specimen of *S. insinuosa* with a U-shaped gonad. Both are aberrant species of the family Styelidae, but it is doubtful whether the resemblance is due to convergence or to close relationship.

Distribution. Antarctic (South Shetlands, King George V Land; South Georgia).

Styela magalhaensis Michaelsen (Text-fig. 43)

Styela canopus var. *magalhaensis* Michaelsen, 1898, p. 367.
?*S. melincae* Ärnbäck, 1929, p. 2.

Occurrence. ?St. 123: S. Georgia, 230–250 m. St. WS 776: Patagonian Shelf, 110–99 m.

External appearance. The single specimen from St. WS 776 is of a squat conical shape with the siphons forming low projections close together on the upper narrow side. Irregular rounded swellings are present on the surface. The general colour is creamy grey. The length and height are both 1·1 cm.

Test. The test, although tough, is not very thick. It is raised in irregular wart-like swellings.

Body wall. Longitudinal and circular muscles are evenly spread over the rather thin body wall, which is brown in the preserved state.

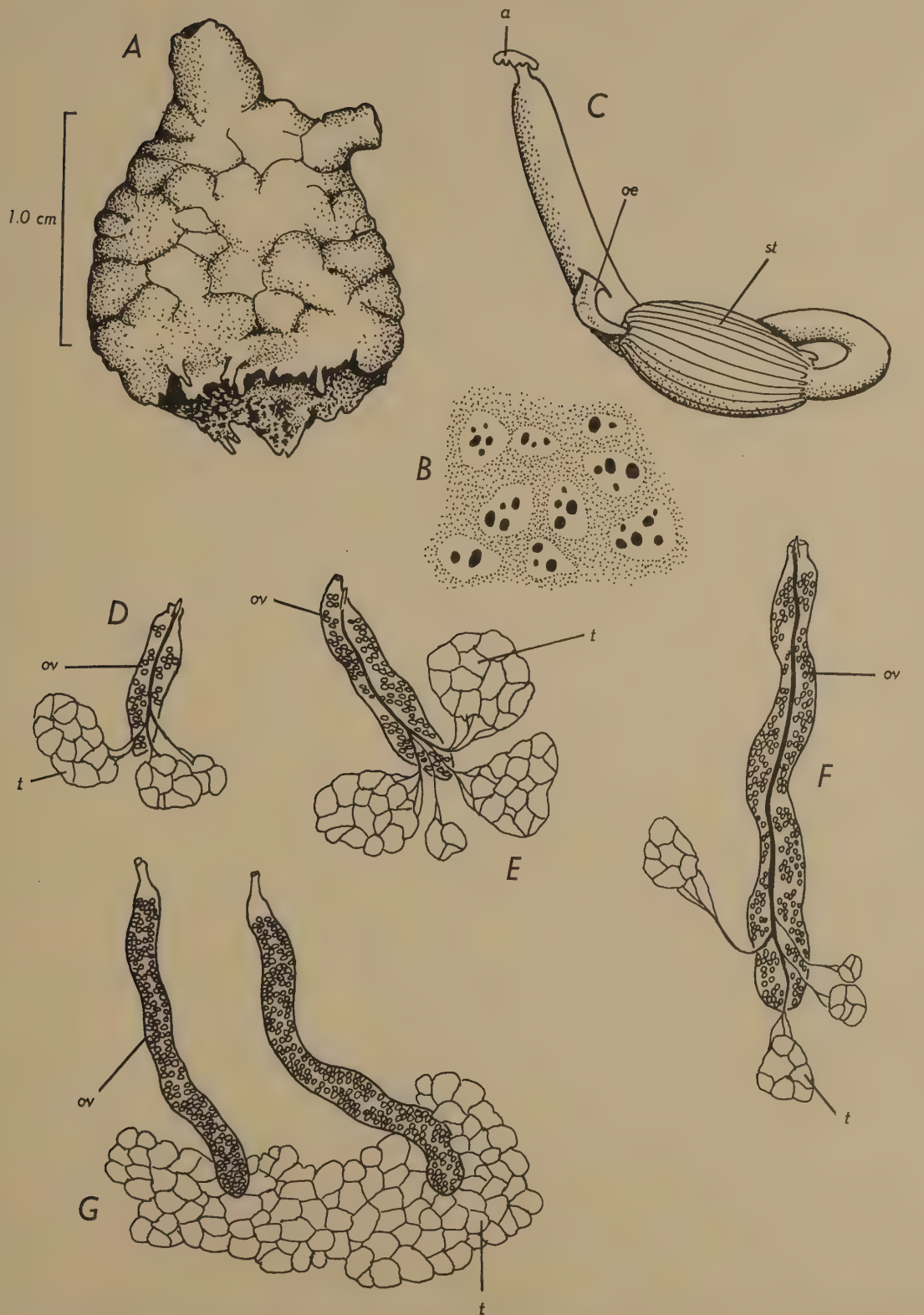
Tentacles. There are about sixty-four of various sizes.

Dorsal tubercle. The dorsal tubercle has a simple U-shaped opening facing forward.

Branchial sac. Each side of the branchial sac is thrown into four quite distinct folds, with the following distribution of longitudinal bars: dorsal line 4 (14) 4 (15) 6 (12) 5 (13) 4 endostyle. The dorsal lamina is a simple membrane with a plain inrolled edge.

Gut. Most of the gut lies in the lower part of the body. The oesophagus is curved, and the walls of the long stomach have about twenty-four longitudinal folds. There is a very small pyloric caecum. The first part of the intestine lies parallel to the stomach, and the rectum bends upwards towards the atrial siphon.

Gonads. One of the most characteristic features of this species is the form of the gonads (Text-fig. 43G). In ripe specimens these constitute two long tubular sinuous ovaries (*ov.*) on each side, with



Text-fig. 43. ? *Styela magalhaensis* Michaelsen (St. 123): A, external appearance; B, part of test; C, gut; D, E, F, gonads. *Styela magalhaensis* Michaelsen (St. WS 776): G, gonads.

a compact mass of testis follicles (*t*) at their lower ends; this is the condition in the 'Discovery' specimen from St. WS 776. Van Name (1945) is a little doubtful if these gonads are sufficiently different from those of *S. paessleri* to justify specific distinction, but on the whole thinks that they are. From a study of the 'Discovery' specimens of *S. paessleri* (see p. 115), and the present specimen I have no hesitation in regarding these as separate species.

There are two specimens from South Georgia (St. 123) which I include in *S. magalhaensis* with some hesitation. Details are as follows.

External appearance. The larger specimen (Text-fig. 43 A) is 1·6 cm. high and 0·9 cm. wide, and the smaller one is 1·2 by 0·8 cm. The body is ovoid to conical in shape with the siphons fairly close together at the upper end. Small tag-like processes are present on the lower part of the body. Elsewhere the surface of the test is divided indistinctly into polygonal plates, each of which has a few brown pigment spots (Text-fig. 43 B).

Body wall. This is thin and semi-transparent, with weak muscles. A few finger-like endocarps are scattered on the inner surface of the body wall.

Tentacles. There are about thirty-three simple curved oral tentacles, which are quite long and alternate in length. Long fine thread-like atrial tentacles are present scattered over a wide area at the base of the atrial siphon.

Dorsal tubercle. The opening of the dorsal tubercle is crescentic and faces forward.

Branchial sac. The longitudinal bars on the four folds are arranged as follows in the larger specimen: dorsal line 3 (14) 4 (12) 5 (13) 8 (11) 8 endostyle.

Gut (Text-fig. 43 C). The oesophagus (*oe.*) is curved. The stomach (*st.*) which lies horizontally, near the base of the body, is oval to diamond-shaped in outline, and has about twenty-four longitudinal folds. Both the intestine and rectum are wide, but immediately before the anus (*a.*) the rectum abruptly narrows. About twelve reflected lobes subdivide the margin of the anus.

Gonads (Text-fig. 43 D–F). Both specimens have two gonads on each side. The ovaries (*ov.*) vary from rather short and straight to quite long and sinuous. At the lower end of each ovary are two, three, or four rounded masses of testis follicles (*t.*), lying at some distance from the ovary.

Remarks. Although I have provisionally included these two specimens in *S. magalhaensis*, the pigmentation and sculpturing of the test, and the failure of the testicular masses to coalesce, are differences which might indicate some systematic distinction. But at present there is too little material, and the similarities to typical specimens of *S. magalhaensis* are too great, to permit separating those two specimens from that species.

A number of other species have been described from the southern part of the South American coast, which are sufficiently like *S. magalhaensis* to raise some doubts regarding their validity. The characters of these species are shown in Table 33 for comparison with the present species.

Conclusions regarding the validity of Herdman's three species must be cautious, as the descriptions are not sufficiently detailed. It does seem, however, that *S. oblonga* differs sufficiently from *S. magalhaensis* to avoid confusion. As nothing is known regarding the gonads or gut of *S. flava*, the species must remain of uncertain value. *S. glans* appears to be very like *S. magalhaensis*, especially in the structure of its gonads. Here again details of the gut are wanting, but *S. glans* might well prove to be a synonym of *S. magalhaensis*. Van Name (1945) has argued that *S. melincae* is identical with *S. magalhaensis*, and the above comparison shows the similarities on which his conclusion rests. Only the numbers of tentacles and of branchial bars on the folds differ markedly and these are both characters varying with body size; Michaelsen's specimens were larger than Ärnbäck's specimens.

Distribution. Subantarctic (southern part of Argentine coast; Magellan region; ?Guaitecas Islands, Chile); Antarctic (MacRobertson Land, South Georgia).

Table 33

	S. magalhaensis Michaelsen	*S. melincae* Ärnbäck	*S. glans* Herdman	*S. oblonga* Herdman	*S. flava* Herdman
Tentacles	About 60	About 24	'Few'	12	About 60
Dorsal tubercle	Arc-shaped, facing forward	C-shaped, facing forward	'Simple'	'Cup-shaped'	'Irregular'
Branchial sac	Well developed. About 20 bars per fold; 4 between	Well developed. 5–9 bars per fold; 2–5 between	Rudimentary. 5 bars per fold; 5 between	Rudimentary. 6–9 bars per fold; 3 between	Low. 10 bars per fold; 10 between
Stomach folds	About 24	About 25	?	?	?
Gonads	2 each side (sometimes only one); testis masses fused near proximal end of ovary	2 each side; testis masses fused near proximal end of ovary	2 each side; testis masses fused near proximal end of ovary	One each side; testis masses in clusters near proximal end of ovary	?

Styela paessleri Michaelsen (Text-fig. 35 D–F)

Styela paessleri Michaelsen, 1898, p. 368.

Occurrence. St. 53: Falkland Islands, 0–2 m. St. WS 841: Patagonian Shelf, 110–121 m.

External appearance. The largest specimen in this collection is 4·0 cm. high and 2·2 cm. wide, and the smallest one 2·5 by 1·4 cm. The body is irregular, varying from dome-shaped to tall and columnar, with the siphons close together at the upper end. The test is wrinkled, leathery and generally some shade of brown.

Tentacles. The oral tentacles are numerous, and I have counted thirty-five and fifty-eight respectively in two specimens of moderate size; Michaelsen (1898) noted about sixty tentacles.

Dorsal tubercle. In two specimens examined the dorsal tubercle was C-shaped with the open interval posterior, and in a third specimen it was in the form of a horizontal S. According to Michaelsen the opening is either a straight slit or a slit with the left end turned back.

Gonads (Text-fig. 35 D–F). The gonads are very characteristic in this species. There are two on each side, each consisting of a branched ovary (*ov.*) and many round or pear-shaped testis follicles (*t*) grouped round the ends of the ovarian branches. The gonads are of the *Styela* type, in which the testis follicles are separate from the ovary instead of being closely united to it within a common membrane as in *Cnemidocarpa*. When fully developed the testis follicles of *S. paessleri* may become closely crowded together to form large irregular masses pressed against the sides of the ovary and to some extent overlapping it. In this way the basic structure of the gonads is to some extent obscured.

Remarks. Kott (1954) records the species from Kerguelen but is a little doubtful about the identification.

Van Name (1945) considered that *S. paessleri* probably includes Michaelsen's species *S. pfefferi*, but as I have pointed out (see p. 100) the latter species is clearly distinguished by its gonads and is in fact a *Cnemidocarpa*.

Distribution. Subantarctic (Falkland Islands to Tierra del Fuego; ?Kerguelen).

Styela partita (Stimpson) (Text-fig. 44)

Cynthia partita Stimpson, 1852, p. 231.

For synonymy see van Name 1945, p. 290, and Tokioka, 1953, p. 262.

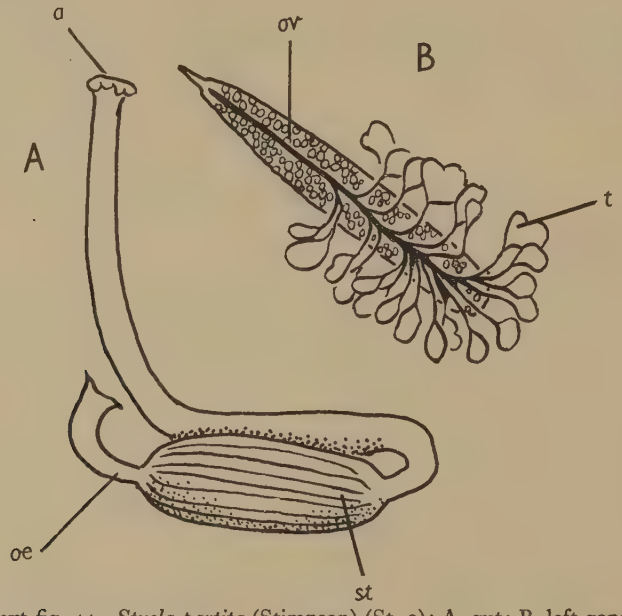
Occurrence. St. 2: Ascension Island, 0 m.

External appearance. The larger of the two specimens has a height of 1·1 cm. and a greatest width

of 0·6 cm., and the smaller specimen is 0·4 cm. high and 0·5 cm. wide. The surface is smooth, shining and slightly wrinkled.

INTERNAL STRUCTURE. This is a well-known species and I shall merely summarize the main characters of the larger of our two specimens. Oral tentacles thirty; atrial tentacles many, short, resembling papillae, and spread over a narrow belt at the base of the atrial siphon. Dorsal tubercle very small with an indistinct opening. Branchial sac—dorsal line 2 (10) 2 (7) 3 (8) 3 (5) 3 endostyle. Stomach with twenty-one folds; anus with six lobes. Gonads two on each side, of the shape shown in Text-fig. 44B.

DISTRIBUTION. Warm waters of Atlantic American coast; English Channel to West Africa; Mediterranean; Japan.



Text-fig. 44. *Styela partita* (Stimpson) (St. 2): A, gut; B, left gonad.

Family PYURIDAE Hartmeyer, 1908

Genus Pyura Molina, 1782

Pyura stolonifera (Heller)

Cynthia stolonifera Heller, 1878, p. 10, pl. 2, fig. 10.
For synonymy see Kott, 1952, p. 274.

OCCURRENCE. St. 90: False Bay, S. Africa, 0–2 m.

EXTERNAL APPEARANCE. The larger of the two specimens is 5·5 cm. high, including a basal extension of test, and 5·0 cm. wide. On the upper side the siphons are close together and prominent. The surface of the body bears some knob-like swellings.

INTERNAL STRUCTURE. In one specimen there are eight and in the other about fourteen dorsal languets. The dorsal tubercle has a complex and much convoluted slit which is basically C-shaped with the open interval directed back to the left. The complex dorsal tubercle, and the shortening of the dorsal side of the branchial sac with consequent reduction in the number of dorsal languets are two characteristic features of the species.

DISTRIBUTION. South Africa; western, southern and eastern Australia; Tahiti.

Pyura setosa (Sluiter) (Pl. IV, fig. 2)

Halocynthia setosa Sluiter, 1905, p. 472.

For synonymy and references see Kott (1954), p. 126.

Occurrence. St. 175: S. Shetlands.

External appearance (Pl. IV, fig. 2). The single specimen is ovoid, 3·5 cm. long and 2·6 cm. high, and almost completely covered with a thick coat of long stiff bristles. These bristles, which reach 13 mm. in length, bear many short pointed spines.

Tentacles. There are about twenty-one compound tentacles of various sizes and a few small almost unbranched ones.

Dorsal tubercle. The dorsal tubercle is C-shaped with the open interval facing forward and a little to the right.

Branchial sac. The anterior part of the dorsal lamina is a toothed membrane, and for most of its length the lamina is represented by long pointed closely crowded languets united basally by a narrow membrane. The longitudinal bars on the six branchial folds are arranged thus: dorsal line 3 (31) 3 (16) 3 (15) 5 (26) 5 (29) 2 (30) 2 endostyle.

Gonads. The left gonad is within the intestinal loop, and the right gonad is a long horizontal sac. The sperm duct and oviduct are short and turned upwards towards the atrial siphon.

Table 34

	P. setosa	*P. stubenrauchi*	*P. echinops*
Test spines	Up to 21 mm. long	Up to 5 mm.	'Short'
Tentacles	About 16	About 30	About 38
Dorsal tubercle	Horse-shoe with inrolled horns; facing forward	Horse-shoe; facing forward	Horse-shoe, inrolled horns, facing forward
Dorsal lamina	Series of languets, anterior ones small, posterior large	A membrane toothed at posterior end	A membrane toothed except at anterior end
Branchial folds	6 each side	4 each side	4 each side
Occurrence	Western and eastern Antarctic	Strait of Magellan	North coast Argentine

Remarks. *P. setosa* is a very distinctive species, but two other species *P. stubenrauchi* (Michaelsen) and *P. echinops* Ärnbäck have been described with similar characters, and the important features of the three are shown in Table 34.

It appears from this comparison that *P. stubenrauchi* and *P. echinops* are the same species as suggested by van Name (1945); the name *P. stubenrauchi* has priority.

P. setosa is distinguished from *P. stubenrauchi* by several characters, but principally the subdivision of the dorsal lamina into languets and the presence of six branchial folds on each side. The two species are nevertheless obviously closely related, having been derived from a common ancestor by geographical speciation.

Distribution. Antarctic (Graham Land, South Orkney Islands, Kaiser Wilhelm II Land, McMurdo Bay, Adelie Land, Enderby Land, MacRobertson Land).

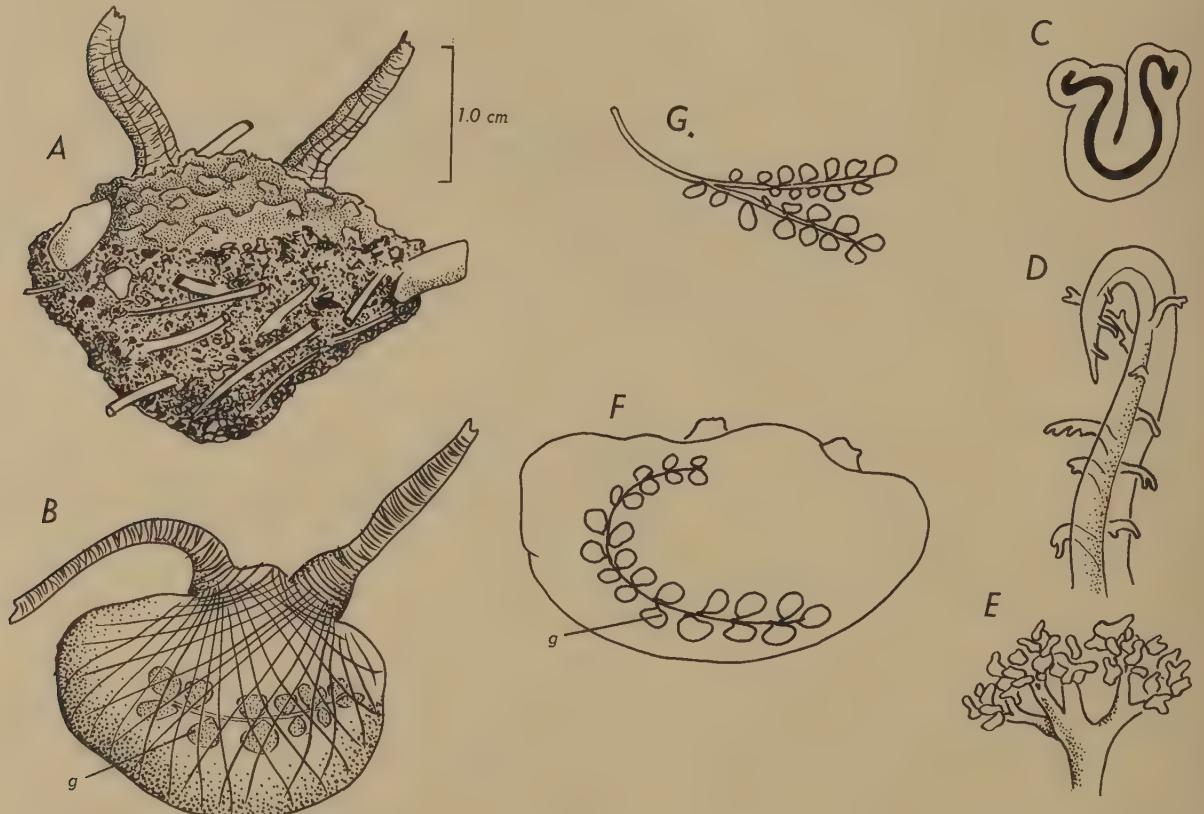
Pyura discoveryi (Herdman) (Text-fig. 45; Pl. IV, fig. 1)

Halocynthia discoveryi Herdman, 1910, p. 9, pl. 4, figs. 6–12.

Occurrence. St. 27: S. Georgia, 110 m. St. 42: S. Georgia, 120–204 m. St. 140: S. Georgia, 122–136 m. St. 144: S. Georgia, 155–178 m. St. 148: S. Georgia, 132–148 m. St. 152: S. Georgia, 245 m. St. 159: S. Georgia, 160 m. St. 160: S. Georgia, 177 m. St. 170: S. Shetlands, 342 m.

St. 177: S. Shetlands, 1080 m. St. 187: Palmer Archipelago, 259–354 m. St. 190: Palmer Archipelago, 93–126 m. St. 474: S. Georgia, 199 m. St. 1948: S. Shetlands, 490–610 m.

External appearance (Text-fig. 45 A). This species is generally found in groups of several individuals growing together, attached basally to bottom material, and to each other by irregular areas of their sides. In some cases there is little or no encrusting matter on the test, but in others the whole body except the siphons is covered with sand, small stones and broken shell. The shape is variable, often upright and sometimes rather squat, and the siphons may be short or remarkably long (Text-fig. 45 A).



Text-fig. 45. *Pyura discoveryi* (Herdman) (St. 474): A, specimen with long siphons; B, the same with test removed; C, dorsal tubercle; D, oral tentacle; E, hepatic tubules; F, showing position of left gonad (St. 1948); G, right gonad of same specimen.

Siphons. According to Kott (1954) there are no spines in the lining of the siphons, and I also can find none.

Tentacles. The tentacles number sixteen to twenty and are only slightly branched (Text-fig. 45 D).

Dorsal tubercle. The opening of the dorsal tubercle is basically U-shaped with the ends of the limbs variously bent; usually both are turned outwards, or the left one outwards and the right one inwards, or one or other may point forward (Text-fig. 45 C).

Branchial sac. Some authors have said that there are six branchial folds on each side (Herdman, 1910; Hartmeyer, 1911; Kott, 1954) and others that there are seven (Sluiter, 1914; Ärnbäck, 1938; van Name, 1945). In all the specimens from the 'Discovery' collection that I have examined there are seven folds, and although the ventral fold is lower than the others, it is unmistakably present. This finding agrees with Ärnbäck's careful review of the question (see Ärnbäck, 1938, pp. 30–2). In

a specimen of length 3·4 cm. the longitudinal bars have the following arrangement: dorsal line 4 (16) 2 (16) 2 (22) 2 (24) 2 (17) 2 (13) 3 (8) 1 endostyle. There is, in some specimens, a slight tendency for the longitudinal bars to project at the posterior ends of the branchial folds, as in *P. jacatrensis*.

Gonads. I have nothing to add to the existing accounts of the gonads, except to note that in one specimen (St. 1948) the right gonad is Y-shaped, having two branches (Text-fig. 45 G).

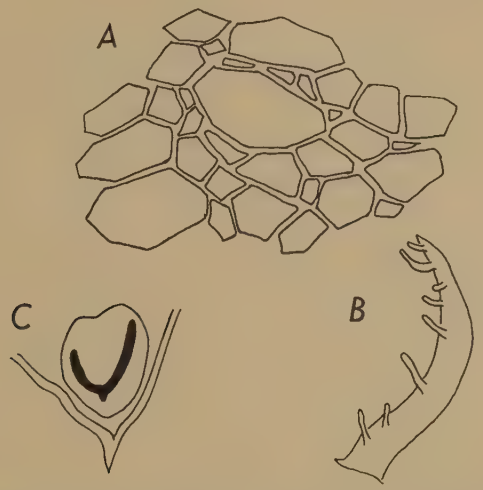
Distribution. Antarctic (McMurdo Bay, Kaiser Wilhelm II Land, Alexander I Land, Graham Land, South Shetlands, Wilkes Land, South Georgia, near Shag Rocks).

Pyura squamata Hartmeyer (Text-fig. 46)

Pyura squamata Hartmeyer, 1909–11, p. 1337 (nomen nudem); 1911, p. 439, pl. 45, fig. 12, pl. 50, figs. 1–5.

Occurrence. St. 187: Palmer Archipelago, 259 m.

External appearance. The single specimen is 1·7 cm. long, 1·0 cm. broad and 0·5 cm. in height. It is yellow-grey in colour and patterned all over with small, mainly hexagonal plates into which the test is divided (Text-fig. 46 A).



Text-fig. 46. *Pyura squamata* Hartmeyer (St. 187): A, part of test; B, oral tentacle; C, dorsal tubercle.

Internal structure. Owing to the damaged condition of the specimen certain details of structure could not be seen. But the form of the tentacles (Text-fig. 46 B) and dorsal tubercle (Text-fig. 46 C), the arrangement of branchial bars, and the shape of the gonads all conform closely to Hartmeyer's description of the type specimen. The anus is divided into seven rounded lobes; in the type specimen the anus was destroyed.

Remarks. This species is characterized principally by the polygonal plates of the test, and the presence of only five well-developed branchial folds, with a rudimentary 6th fold.

In spite of the damaged state of the only specimen in the 'Discovery' collection I have no hesitation in assigning it to *P. squamata*.

Distribution. Antarctic (Kaiser Wilhelm II Land, Charcot Land, Palmer Archipelago).

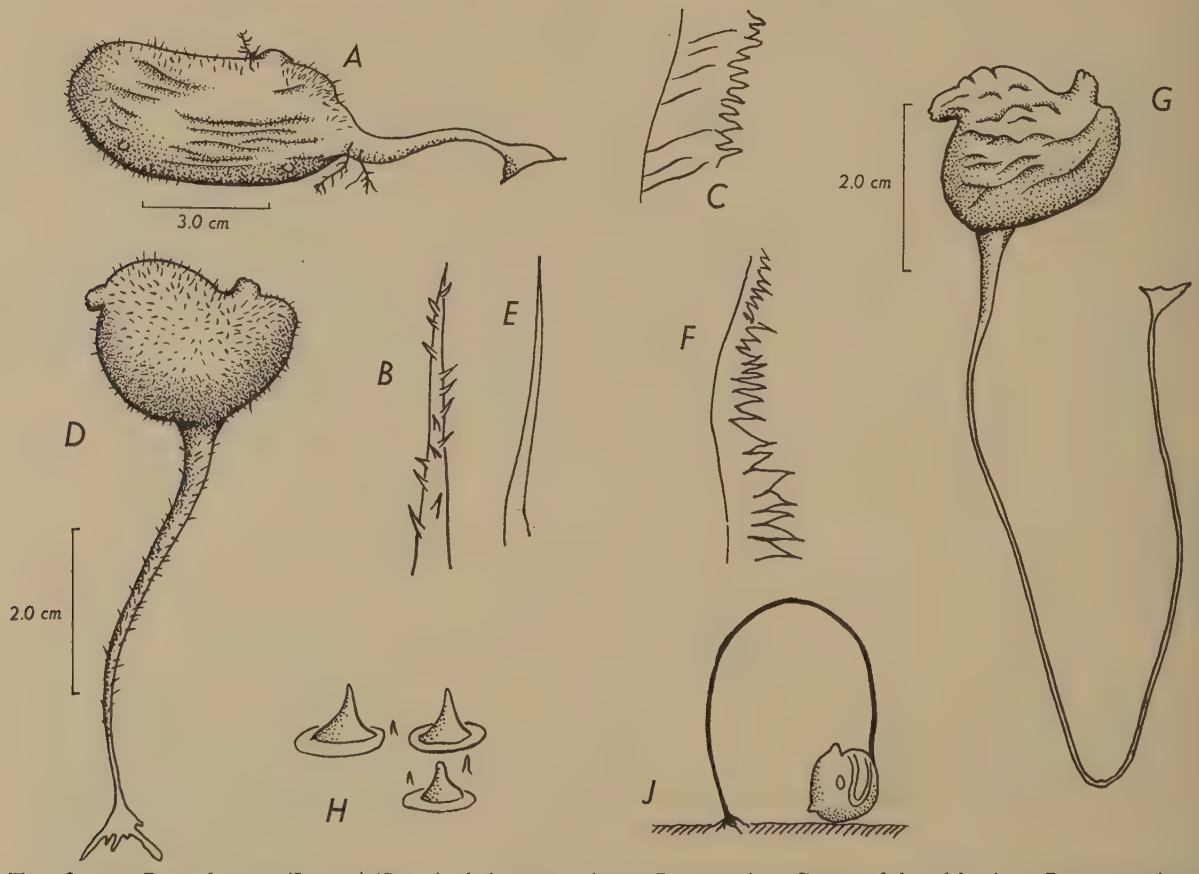
Pyura legumen (Lesson) (Text-figs. 47 A, B, C; 48; Pl. IV, fig. 6)

Boltenia legumen Lesson, 1830, p. 149, pl. 53, fig. 1.
For synonymy see van Name, 1945, p. 326.

Occurrence. St. 52: Falkland Islands, 17 m. St. 53: Falkland Islands, 0–2 m. St. 55: Falkland Islands, 10–16 m. St. 56: Falkland Islands, 10·5–10 m. St. 57: Falkland Islands, 15 m. St. WS 71:

Falkland Islands, 82–80 m. St. WS 84: Falkland Islands, 75–74 m. St. WS 89: Tierra del Fuego, 23–21 m. St. WS 90: Patagonian Shelf, 82–81 m. St. WS 788: Patagonian Shelf, 82–88 m. St. WS 811: Patagonian Shelf, 99 m. St. WS 834: Patagonian Shelf, 27–28 m. St. WS 852: Patagonian Shelf, 86–88 m.

External appearance (Text-fig. 47A; Pl. IV, fig. 6). The general appearance of this species is already well known. In almost all the 'Discovery' specimens the point of origin of the stalk is at the anterior ventral part of the body, but in some small ones it is mid-ventral. The proportion of body



Text-fig. 47. *Pyura legumen* (Lesson) (St. 57): A, intact specimen; B, test-spine; C, part of dorsal lamina. *Pyura georgiana* Michaelsen (St. MS 14): D, intact specimen; E, test-spine; F, part of dorsal lamina. *Pyura bouvetensis* (Michaelsen) (St. 181): G, intact specimen; H, test-spines; J, probable attitude in life with body resting lightly on the bottom.

length to stalk length bears no direct relation to the total size of the animal, that is, to its age (see Text-fig. 48). Irregular longitudinal furrows mark the surface, and in some animals these break the test into rectangular or polygonal areas each bearing a group of spines. The degree to which spines are developed is very variable. They may be numerous and short, forming a kind of fur, or few and scattered. When well developed the spines reach 2 mm. in length, are sharply pointed, and bear small thorn-like processes (Text-fig. 47B).

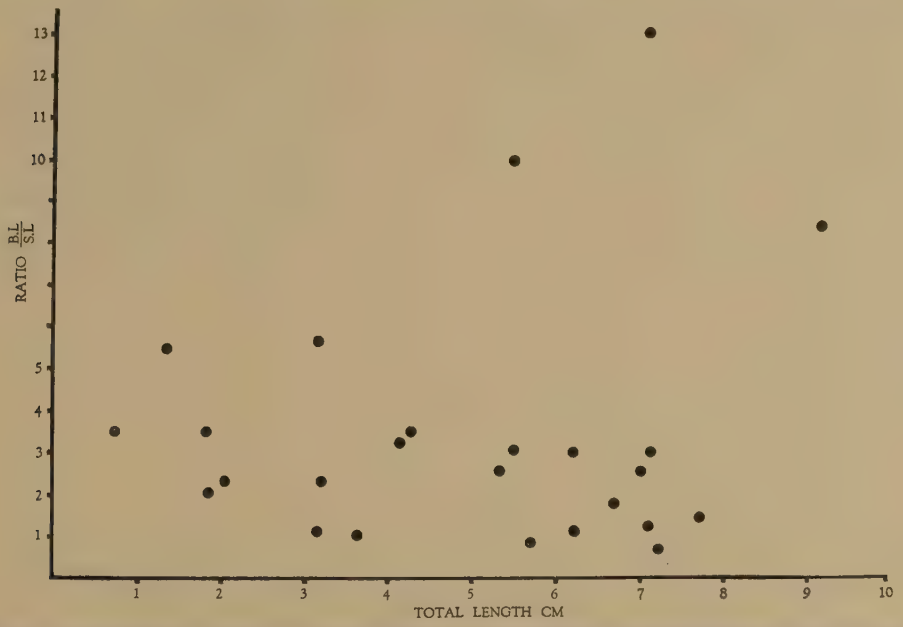
Atrial organs. The three pads, called atrial organs, which lie within the atrial siphon, at its base, have been noticed by several workers, especially Michaelsen (1900) and Ärnbäck (1938). The structure and function of the organs, however, have never been clarified. Sections show that the atrial organs are thick pads of test substance richly provided with blood spaces. As these spaces are lined with

epidermis they are to be regarded as specially developed test vessels. Great numbers of blood cells, many of them phagocytes, lie in the test matrix. The function of the atrial organs is still unknown.

Parietal organs. Michaelsen (1900) noted the existence of other enigmatic structures which have become known as the parietal organs. These were described as a pair of swellings of the body wall, one on each side, and containing vacuolated cells. I have examined many specimens of *P. legumen* without finding parietal organs, although they are easily seen in related species (see p. 122), and I can only conclude that they are not always present or recognizable in *P. legumen*.

Branchial sac. In a specimen with body 3·9 cm. and stalk 3·2 cm. the branchial sac has the following arrangement of longitudinal bars: dorsal line 2 (22) 2 (13) 3 (20) 3 (20) 3 (15) 4 (12) 1 (3) 1 endostyle.

Biology. There are not enough specimens to indicate the breeding season of this species.



Text-fig. 48. *Pyura legumen* (Lesson). Relation between the ratio body-length/stalk-length and the total length.

In some animals the intestine is filled with plankton organisms, mainly small algal cells and *Globigerina* sp. together with diatoms.

Remarks. I discuss this and the two related species *P. georgiana* and *P. bouvetensis* on p. 124.

Distribution. Subantarctic (Falkland Islands, Patagonian Shelf, Magellen region).

Pyura georgiana (Michelsen) (Text-figs. 47D–F; 49; 50; Pl. IV, fig. 7)

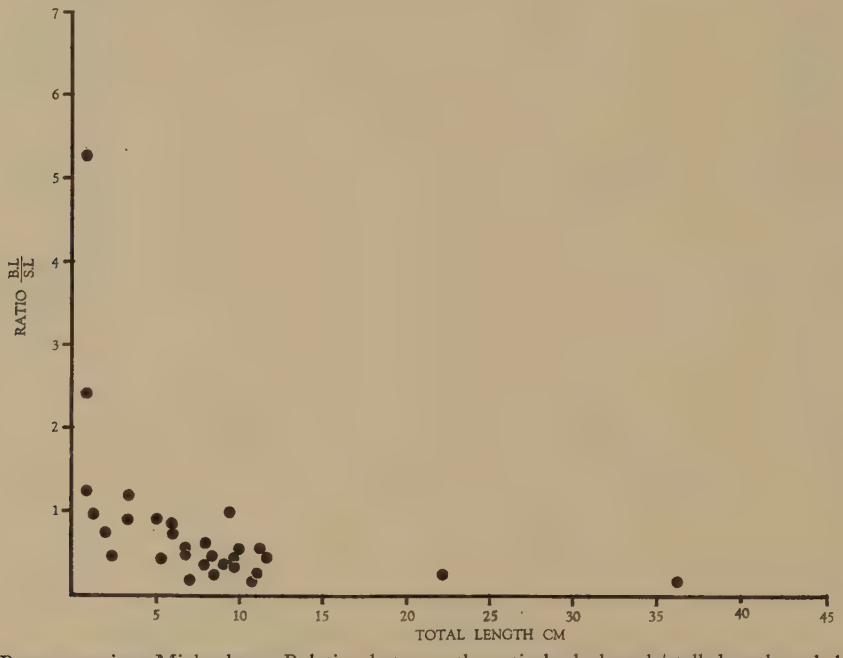
Boltenia georgiana Michaelsen, 1898, p. 364.

Occurrence. St. 39: S. Georgia, 179–235 m. St. 42: S. Georgia, 120–204 m. St. 123: S. Georgia, 230–250 m. St. 140: S. Georgia, 122–136 m. St. 144: S. Georgia, 155–178 m. St. 145: S. Georgia, 26–35 m. St. 148: S. Georgia, 132–148 m. St. 152: S. Georgia, 245 m. St. 156: S. Georgia, 200–236 m. St. WS 62: S. Georgia, 26–83 m. St. WS 567: S. Georgia, 145 m. St. MS 14: S. Georgia, 190–110 m. St. MS 68: S. Georgia, 220–247 m.

External appearance (Text-fig. 47D; Pl. IV, fig. 7). This species differs from *P. legumen* in having the stalk originating from near the middle, or somewhat towards the anterior end, of the ventral side, instead of at the extreme anterior end of that side, and passing down ventrally from the body and not

as an oblique continuation of the long axis of the body, as in *P. legumen*. If the ratio of the height (i.e. dorso-ventral diameter) of the body to the length of the stalk is plotted against the total length of the specimen, it is seen that this ratio decreases with increase of total length, that is presumably with age (Text-fig. 49). Old animals may have a stalk from three to eight times the dorso-ventral diameter of the body, whereas in young animals the stalk may barely equal the diameter of the body. As in *P. legumen* the surface of the body bears a sparse but variable coating of spines (Text-fig. 47E). In *P. georgiana* however, the spines usually lack the secondary thorn-like processes commonly found in *P. legumen*.

Parietal organs. This species has no atrial organs within the base of the atrial siphon, but in every specimen dissected a parietal organ was found on the middle of each side of the body. Sections show



Text-fig. 49. *Pyura georgiana* Michaelsen. Relation between the ratio body-length/stalk-length and the total length.

that the parietal organs consist of a number of closely packed rounded vesicles (Text-fig. 50A, *v.*), each vesicle being composed of many vacuolated cells (Text-fig. 50B, *v.c.*). It is not clear whether these cells remain separate although crowded together, or whether they form a syncytium. In fixed and sectioned material the vacuoles of the cells are empty, and it is not possible to say whether the parietal organs may be stores of reserve material, or, as Kott (1954) suggests, renal organs.

Ärnbäck (1938) has well described the remaining internal organs of the species.

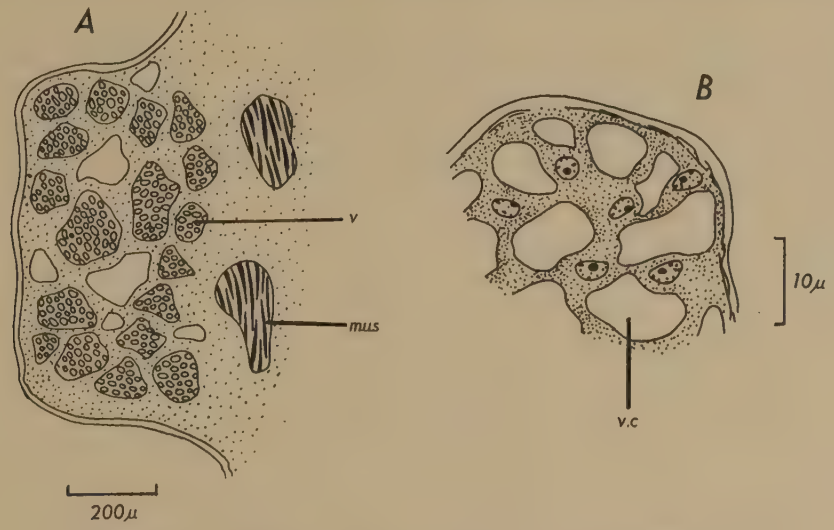
Biology. One large animal from St. 123, collected on 15 December 1926, has several small specimens of the same species attached to its test. These young ones had a body ranging from 0·25 to 0·70 cm. in diameter and apparently represented a settlement from one breeding season. Without knowing the rate of growth, however, it is not possible to say when breeding took place but it may have been within the previous month, that is in late November or early December.

Remarks. The range of depth given by van Name (1945) suggests that this is a shallow water species, but in fact it has generally been taken from depths of 100–200 m., although Michaelsen's (1900) original record was from water of 16–25 m. Most of the 'Discovery' material is from depths of more than 100 m.

Ärnbäck (1938, p. 37) discusses the possibility that *P. scotti* Herdman and *P. antarctica* van Beneden are identical with *P. georgiana*.

There is a single record of two specimens from the northern part of the Argentine coast, 37° 50′ S., 56° 11′ W., by Ärnbäck (1938). This is a locality far north of all others from which *P. georgiana* has been taken and were it not given on Ärnbäck's authority the record would require confirmation.

DISTRIBUTION. Antarctic (South Georgia), Subantarctic (north coast of Argentine).



Text-fig. 50. *Pyura georgiana* Michaelsen: A, section through the parietal organ to show vesicles (*v.*); B, part of a vesicle, at higher magnification, to show vacuolated cells (*v.c.*).

Pyura bouvetensis (Michaelsen) (Text-fig. 47 G, H, J; Pl. IV, figs. 4, 5)

Boltenia bouvetensis Michaelsen, 1904, p. 216, pl. 10, fig. 6; pl. 11, figs. 23, 24.
Boltenia salebrosa Sluiter, 1905, p. 474; 1906, p. 45; 1906*a*, p. 554.
Boltenia turqueti Sluiter, 1905, p. 474.
Boltenia turqueti Hartmeyer, 1909–11, p. 1342; Sluiter, 1914, p. 11; Ärnbäck, 1938, p. 37; van Name, 1945, p. 331.
?*Pyura legumen* Kott, 1954, p. 124.

OCCURRENCE. St. 170: S. Shetlands, 342 m. St. 181: Palmer Archipelago, 160–335 m. St. 187: Palmer Archipelago, 259–354 m. St. 190: Palmer Archipelago, 93–126 m. and 315 m. St. 195; S. Shetlands, 391 m. St. 599: S. Shetlands, 203 m. St. 600: S. Shetlands, 501–527 m. St. 1952: S. Shetlands, 367–383 m. St. 1955: S. Shetlands, 440–410 m.

EXTERNAL APPEARANCE (Text-fig. 47 G; Pl. IV, figs. 4, 5). The largest of the many specimens has a stalk of 21·0 cm. and a body of 3·0 cm. long (antero-posteriorly) by 2·3 cm. high (dorso-ventrally). In the smallest complete specimen the stalk is 3·0 cm. and the body 1·2 cm. long by 1·1 cm. high. The stalk originates from the antero-ventral part of the body, is moderately thick here, and becomes gradually thinner towards the lower end. A stalk so slender and flexible could not support the body which may in fact rest on the bottom (Text-fig. 47 J). In appearance and texture the surface of the body varies from brown, wrinkled and fairly tough to pale ochre, smooth and so thin as to be semi-transparent. In the latter case the parietal organs, gut and branchial folds can be seen through the test. A slight swelling, small disc, or group of root-like processes serve to attach the stalk to the substratum. The surface of the test is beset with short conical spines each standing on a circular disc-shaped area of test (Text-fig. 47 H). These spines are very different from those of either *P. legumen* or *P. georgiana*.

Body wall. The body wall is thin, with narrow but distinct circular muscles round the siphons and narrow longitudinal muscles radiating across the body from the siphons. The siphons are small and wart-like.

Parietal organs. About the centre of the left side of the body above the intestinal loop, there is a small ovoid parietal organ and another at a corresponding point on the right side. This species has no atrial organs.

Tentacles. In large specimens there are about twelve large compound tentacles and a few very small ones between them.

Dorsal tubercle. The dorsal tubercle has a C-shaped slit with the horns turned inwards or spirally coiled.

Branchial sac. On the margin of the wide dorsal lamina there is a series of distinct teeth. The longitudinal bars of a large specimen are arranged as follows: dorsal line 5 (22) 3 (21) 2 (23) 3 (24) 6 (18) 3 (22) 2 (17) 7 endostyle.

Gut. The gut is bent into a long flat U-shaped loop lying far down in the ventral half of the left side. At the posterior end of the body is the curved oesophagus, which leads to the short pear-shaped stomach with walls bearing twenty or more narrow folds. The intestine and rectum are narrow, and bent so that the anus lies close to the oesophagus.

Gonads. The gonads are long and narrow, the left one within the intestinal loop and the right one at a corresponding position on the opposite side. In each gonad the ovary is long and continuous, and the testis is developed as a series of about four swellings along the length of the gonad.

Remarks. I agree with van Name (1945) that there is no reason for separating *P. bouvetensis*, which Michaelsen (1904) described from the neighbourhood of Bouvet Island, from the much better-known *P. turqueti* of the Graham Land region. Owing to an error of Michaelsen's it was originally thought that the gonads of *P. bouvetensis* differed from those of related species, but now that this mistake has been put right, *P. bouvetensis* and *P. turqueti* are indistinguishable.

Distribution. Antarctic (Bouvet Island, Graham Land region, South Shetland Islands, ?Victoria Land as *P. scotti* Herdman, 1910, ?Enderby Land, ?MacRobertson Land as *P. legumen* Kott, 1954).

The relationship of P. legumen, P. georgiana *and* P. bouvetensis

These three species constitute a natural and closely related group, but their validity as separate species has been questioned. Of recent authors, Ärnbäck (1938) and van Name (1945) have both maintained the three species, although van Name was a little doubtful whether *P. legumen* and *P. georgiana* should be separated. Kott (1954), however, definitely identifies *P. turqueti* with *P. legumen*, after examining material from Enderby Land and MacRobertson Land, which apparently showed a great variety of external form. I cannot agree with this, as the presence of atrial organs readily distinguishes *P. legumen* and from *P. bouvetensis* (syn. *P. turqueti*). Moreover, the locality of the specimens which she identified as *P. legumen* was in the high Antarctic, very different from the well-localized area of distribution of *P. legumen* in the Subantarctic.

The rich 'Discovery' material shows, I think, that the three forms are best regarded as three separate species. One of these, *P. legumen*, is confined to the Subantarctic waters of the Falkland Islands, Patagonian Shelf and Magellan region. The other two are Antarctic species: *P. georgiana*, probably with a very local distribution round South Georgia, and *P. bouvetensis*, which is circumpolar. The two latter species are more closely related to one another than to *P. legumen*. This close relationship is shown by both having parietal organs but no atrial organs, and by the relatively long stalk.

The forms that we have been considering present a case of the breaking up of a population into species which, at their present stage of evolution, still show their close relationship.

Pyura jacatrensis (Sluiter) (Text-fig. 51)

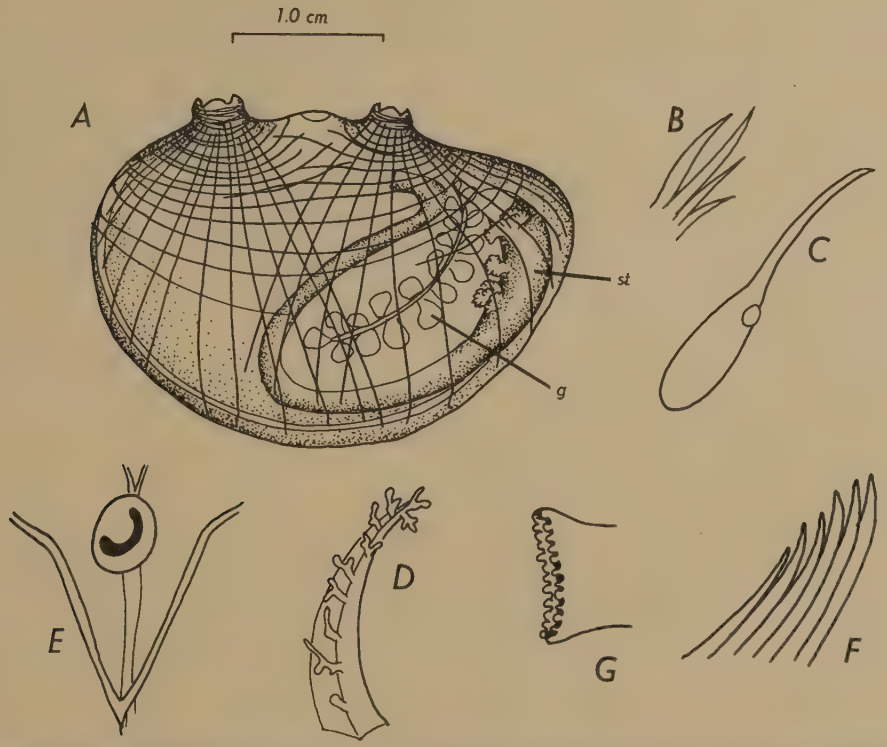
Cynthia jacatrensis Sluiter, 1890, p. 331, pl. 1, figs. 8, 9.
For synonymy see Kott 1954, p. 127.

Occurrence. St. 1563: Marion Island, S. Indian Ocean. 113–99 m.

External appearance. The single specimen is 3·2 cm. long and 2·2 cm. high, of an ovoid shape and almost completely covered by sand, shell and debris. The siphons are visible externally as short wide tubes more or less free of encrusting matter.

Test. The test is not very thick, but is tough. Its inner surface is pale grey. On the lining of the siphons there are slender pointed spines (Text-fig. 51 B, C) agreeing with those found by Kott (1954).

Body wall. On the body wall the muscles which radiate from the siphons are quite numerous, and regularly arranged (Text-fig. 51 A). The circular muscles are not numerous, except on and near the siphons.



Text-fig. 51. *Pyura jacatrensis* (Sluiter) (St. 1563): A, specimen with test removed; B, spines from lining of oral siphon; C, one of the spines at higher magnification; D, oral tentacle; E, dorsal tubercle; F, posterior end of a branchial fold; G, anus.

Tentacles. There are sixteen oral tentacles (Text-fig. 51 D) of alternating sizes. The primary branches are short and only very slightly divided.

Dorsal tubercle. The opening of the dorsal tubercle is a small crescentic slit with the open interval facing obliquely to the right and forward (Text-fig. 51 E).

Branchial sac. Six sharply defined folds are present on each side of the branchial sac, with longitudinal bars thus arranged: dorsal line 1 (14) 3 (16) 3 (16) 2 (17) 2 (15) 3 (11) 3 endostyle.

There are about thirteen stigmata to each mesh on the flat parts between folds. The dorsal lamina is represented by about forty narrow pointed languets. At the posterior end of each branchial fold the longitudinal bars are prolonged as groups of slender processes (Text-fig. 51 F).

Gut. A number of branched hepatic lobes are given off from the surface of the stomach (*st.*) but as they are few, most of the stomach is exposed. The primary loop of the gut is rather widely open. Kott (1952) has described the anal border in this species as 'smooth' in her Australian specimens, and as 'gently indented, but not divided into distinct lobes', in a later publication (Kott, 1954) dealing with material from Macquarie Island, Kerguelen and Tasmania. The 'Discovery' specimen from Marion Island has the anal border minutely cut into about thirty very short lobes (Text-fig. 51 G).

Gonads. One curved gonad (*g*) lies on each side of the body and comprises about twelve pairs of sac-like lobes arranged along the gonoducts.

Remarks. Apart from the subdivision of the anal border, this specimen is in good agreement with Kott's (1952, 1954) accounts of *P. jacatrensis*. It appears doubtful, however, whether this species is sufficiently distinct from *P. vittata* (Stimpson). In her key to the species of *Pyura*, Kott (1952, pp. 260–3) separates *P. jacatrensis* from *P. vittata* by the smooth anal border of the former and the lobed border of the latter. But there are differences in the published descriptions of the anal border in *P. vittata*. Thus according to van Name (1945) the border is 'usually with rounded lobes', and it is variously described by Tokioka as indistinctly lobed (1949), 'not lobed' (1950) and 'plainly margined' (1952). In spite of the unsatisfactory nature of the distinctions, it is unlikely that the two species are the same, since *P. vittata* is known chiefly from the tropical and subtropical waters of eastern America and West Africa, and from Japanese waters, whereas *P. jacatrensis* has been recorded from Indonesia, Western Australia, Tasmania, Kerguelen and Macquarie Island. Further evidence might show that the records from warm waters refer to *P. vittata*, and those from Kerguelen, Marion Island, Macquarie Island and perhaps Tasmania refer to a different species. But there is not yet enough information to make a decision possible.

Distribution. Indonesia, Western Australia, Tasmania, Subantarctic (Macquarie Island, Marion Island), Antarctic (Kerguelen).

Pyura vittata (Stimpson)

Cynthia vittata Stimpson, 1852, p. 230.
For synonymy see van Name, 1945, p. 321.

Occurrence. St. 1: Ascension Island, S. Atlantic Ocean, 16–27 m.

External appearance. The single specimen measures 2·0 by 1·5 cm., has a very irregular outline owing to the presence of rounded swellings on the surface, and is dirty pale grey in colour.

Internal structure. The specimen was somewhat damaged but all details which were seen are typical of the species, and may be summarized as follows: Tentacles 32. Dorsal tubercle with C-shaped slit having inrolled horns. Thirty slender dorsal languets. Six branchial folds with bars arranged thus: dorsal line 3 (13) 5 (17) 3 (17) 4 (20) 8 (15) 6 (12) 7 endostyle. Stomach with large branched liver. Endocarps along dorsal side of intestine. Gonads not present. The only point needing special mention is the two-lipped anus. This does not agree with van Name's (1945) description of the species as found in tropical American waters, the nearest locality with adequately described specimens. But the apparently variable form of the anal margin (see remarks under *P. jacatrensis*) shows that it is not an important diagnostic character.

Distribution. Warm waters of the Atlantic coast of America; west Africa, Ascension Island, Japan.

Genus Herdmania Lahille, 1887

Herdmania momus (Savigny) (Text-fig. 52)

Cynthia momus Savigny, 1816, p. 143, pl. 1, fig. 2; pl. 4, fig. 1.
For synonymy see Kott, 1952, p. 279 (var. *grandis*), p. 281 (var. *galei*), p. 282 (var. *curvata*).

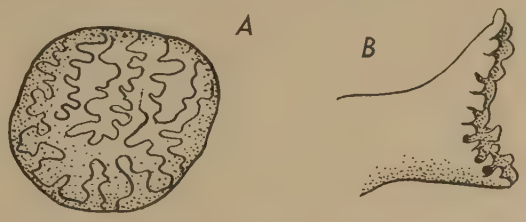
Occurrence. St. 1686: Victoria, Australia, 0 m.

External appearance. The single specimen measures 11 cm. long by 7 cm. high, and is heavily encrusted with hydroids and other organisms. The short wide siphons are visible externally.

Internal structure. As the species has been described in detail by several authors (see particularly van Name, 1945; Kott, 1952; and Tokioka, 1953) I shall mention only a few important features of this specimen.

Dorsal tubercle. The tubercle is a large conspicuous cushion with a complicated sinuous slit (Text-fig. 52 A), similar to that illustrated by Kott (1952, fig. 124), for var. *grandis*.

Branchial sac. There are fourteen folds on one side of the branchial sac, with up to thirty longitudinal bars on the larger folds, and several between folds.



Text-fig. 52. *Herdmania momus* (Savigny) (St. 1686): A, dorsal tubercle; B, anus.

Gut. About twenty-four lobes surround the anal opening (Text-fig. 52 B).

Remarks. This is a very variable species, but is always readily identified by the spicules in the body wall and branchial sac, and by the large number of branchial folds.

Several varieties and forms (see Michaelsen, 1919; Kott, 1952) have been described and for a discussion of these van Name (1945) and Tokioka (1953) should be consulted. Both of these latter authors suggest that the subdivisions of the species have little systematic value, but nothing can be added to the argument here on evidence from one specimen. This specimen agrees closely with the description of var. *grandis*, which is characterized specially by (1) the large size, (2) the large number of branchial folds (ten to thirteen on each side), and (3) the large and complex dorsal tubercle.

Distribution. Widely spread in warm waters of the world.

Genus **Bathypera** Michaelsen, 1904

Bathypera splendens Michaelsen (Text-fig. 53)

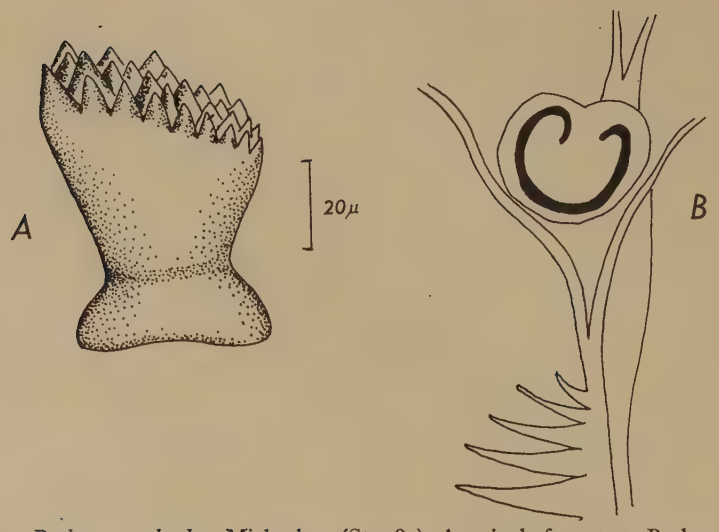
Bathypera splendens Michaelsen, 1904, p. 192, pl. 10, fig. 9; pl. 11, figs. 15–19.
Pyura liouvillia Sluiter, 1912, p.. 543

Occurrence. St. 181: Palmer Archipelago, 160–335 m.

External appearance. The body of the single specimen is roughly spherical, approximately 2 cm. in diameter and slightly flattened on the dorsal side, where the siphons make two small, widely separated, conical projections. The general colour is grey, paler on the siphons, and the surface feels rough to the touch owing to the presence of the characteristic test spicules (Text-fig. 53 A) arranged at right angles to the surface.

Internal structure. Several detailed descriptions (Michaelsen, 1904; Hartmeyer, 1911; Herdman, 1923; Kott, 1954) leave little to be added. In the 'Discovery' specimen the dorsal tubercle has a complete C-shaped slit (Text-fig. 53 B), not broken into two parts as in Kott's description. Michaelsen described and illustrated a short oviduct and sperm duct, but in Kott's specimens these were much longer. The present specimen shows only moderately long ducts.

Distribution. Antarctic (Graham Land, Enderby Land, Kaiser Wilhelm II Land, Adelie Land, Wilkes Land, MacRobertson Land).



Text-fig. 53. *Bathypera splendens* Michaelsen (St. 181): A, spicule from test; B, dorsal tubercle.

Family MOLGULIDAE Lacaze-Duthiers, 1877

Genus **Molgula** Forbes & Hanley, 1848

Molgula pedunculata Herdman (Text-fig. 54; Pl. V, fig. 4)

Molgula pedunculata Herdman, 1881, p. 234.
For synonymy see van Name (1945).

Occurrence. St. 27: S. Georgia, 110 m. St. 39: S. Georgia, 179–235 m. St. 42: S. Georgia, 120–204 m. St. 45: S. Georgia, 238–270 m. St. 123: S. Georgia, 230–250 m. St. 140: S. Georgia, 122–136 m. St. 144: S. Georgia, 155–178 m. St. 160: Shag Rocks, 177 m. St. 190: Palmer Archipelago, 93–126 m. St. 599: Graham Land, 203 m. St. WS 27: S. Georgia, 107 m. St. MS 68: S. Georgia, 220–247 m.

External appearance. The largest of the many specimens in the collection is 2·6 cm. long. Almost all of them show some degree of the development of tag-like processes or short hairs on the test. The body is longer than wide, and is generally ovoid or somewhat rectangular, with the siphons symmetrically placed on the upper border. In some specimens, more often the small ones, the lower part of the body is produced into a narrow stalk, which is occasionally almost as long as the body, but is generally much shorter.

Internal structure. The variation in the internal structure of the 'Discovery' specimens will be discussed in relation to Ärnbäck's (1938) account of her species *M. angulata*, to which, in her preliminary notes, she assigned a number of specimens in the 'Discovery' collection. Table 35 gives the main characters of *M. angulata*, and of the 'Discovery' specimens which I identify as *M. pedunculata*.

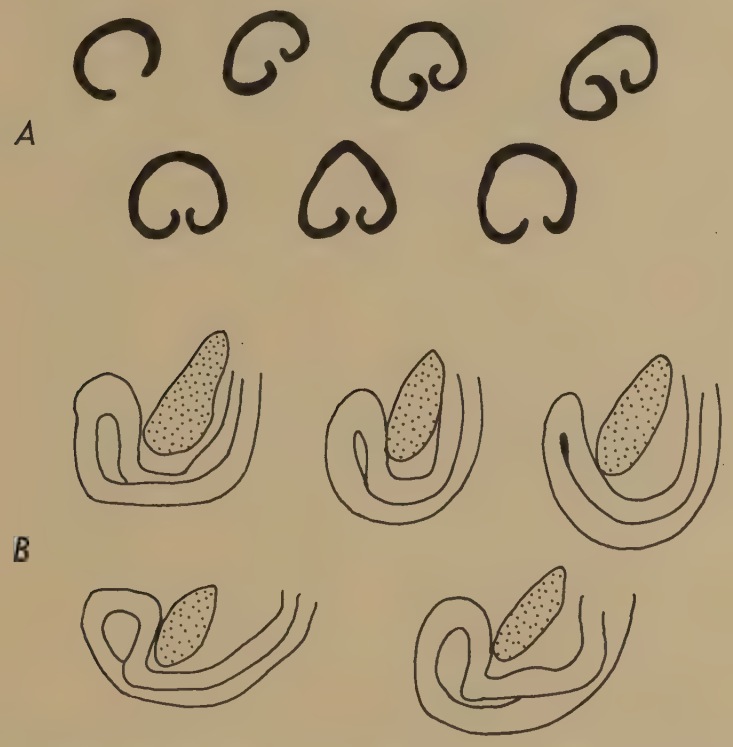
Table 35

	M. angulata	*M. pedunculata* ('Discovery' specimens)
Tentacles	At least 20; the largest bipinnate	Usually 12–16; the largest tri-pinnate
Dorsal tubercle	Transversely elongated; horns inturned; faces back left	Sometimes transversely, sometimes longitudinally elongated; horns usually inrolled; usually faces back left (see Text-fig. 54A)
Branchial sac	7 folds; about 11 bars per fold; 1 or 2 bars between folds	7 folds; 6–13 bars per fold; 1–4 bars between folds
Gut	Sharp bend in intestine	Intestine variously curved, sometimes with sharp bend (see Text-fig. 54B)

Text-fig. 54 supplements the information in Table 35 by showing some forms of dorsal tubercle and intestine in the present specimens. These comparisons show that the type and only specimen of Ärnbäck's *M. angulata* lies within the range of variation of the much more abundant 'Discovery' material, which is readily identifiable as *M. pedunculata*. *M. angulata* must therefore be regarded as a synonym of *M. pedunculata*, as suggested by van Name (1945).

Remarks. See p. 137 for notes on the differences between this species and *M. sabulosa* (Quoy & Gaimard) which Kott (1952, 1954) believes to be identical.

Distribution. Antarctic (Graham Land, Kaiser Wilhelm II Land, South Georgia, Kerguelen).



Text-fig. 54. *Molgula pedunculata* Herdman: A, different forms of opening of the dorsal tubercle; B, different forms of gut (clear) and left gonad (stippled).

Molgula falsensis Millar (Text-fig. 55)

Molgula falsensis Millar, 1955, pp. 217–9, fig. 40.

Occurrence. St. 91: False Bay, S. Africa, 35 m.

External appearance (Text-fig. 55 A). The six specimens range from 8 by 8 mm. up to 13 by 7 mm. All of them are covered with adhering fragments of shell and grains of sand.

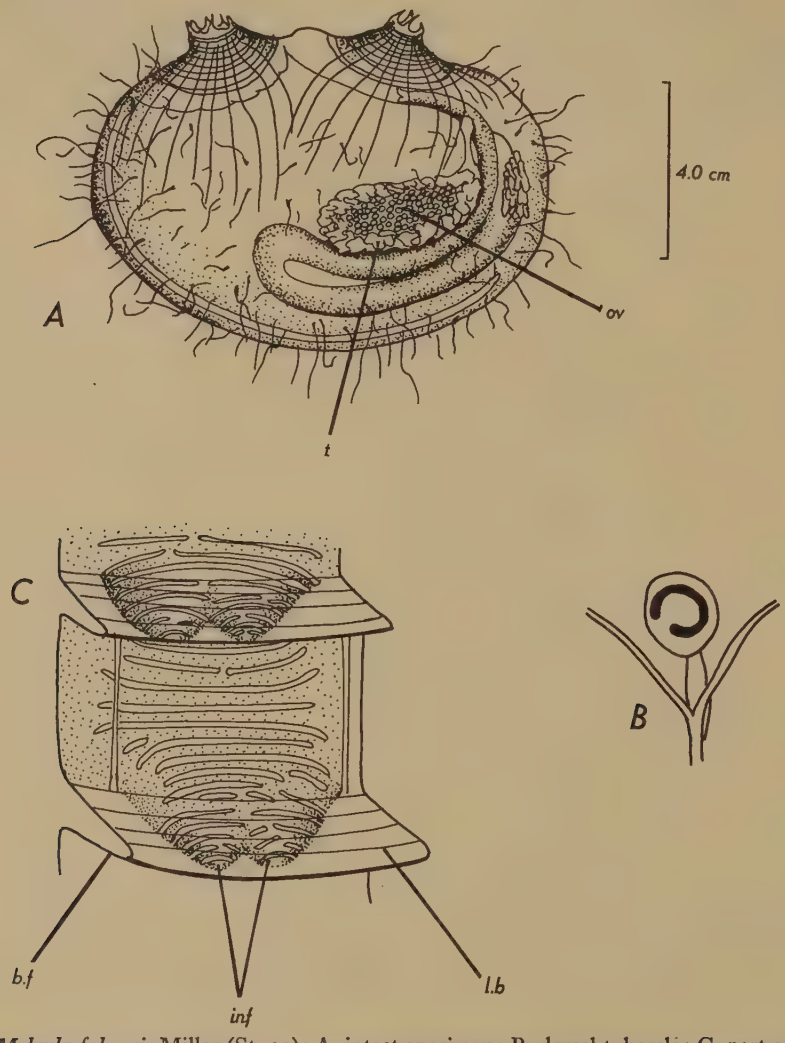
Test. The test is thin, flexible and transparent and has a sparse coating of very fine hairs.

Body wall. Muscles which radiate from the siphons extend only a short distance across the sides of the body; other muscles, oblique and circular, are very few, except round the siphons.

Tentacles. There are about twenty-one oral tentacles, of which four or five are large and tripinnate. Only eight to ten tentacles were present in the type specimens (Millar, 1955).

Dorsal tubercle. The C-shaped opening of the dorsal tubercle faces backwards and to the right (Text-fig. 55 B).

Branchial sac. There are seven tall narrow branchial folds, with the following arrangement of longitudinal bars in a large specimen: dorsal line o (6) o (7) o (8) o (8) o (6) o (6) o (5) o endostyle. The absence of bars between folds was also noted in the type specimens. The infundibula are very regular (Text-fig. 55 C, *inf.*).



Text-fig. 55. *Molgula falsensis* Millar (St. 91): A, intact specimen; B, dorsal tubercle; C, part of branchial wall.

Gut. The primary loop of the intestine is almost closed, and the secondary loop very open.

Gonads. The left gonad occupies the secondary gut loop and the right gonad lies immediately above the renal sac. The sac-like ovary (*ov.*) has an upturned oviduct with crescentic opening, and is fringed by numerous testis follicles (*t*).

Distribution. False Bay, South Africa.

Molgula platei Hartmeyer (Text-fig. 56; Pl. V, fig. 7)

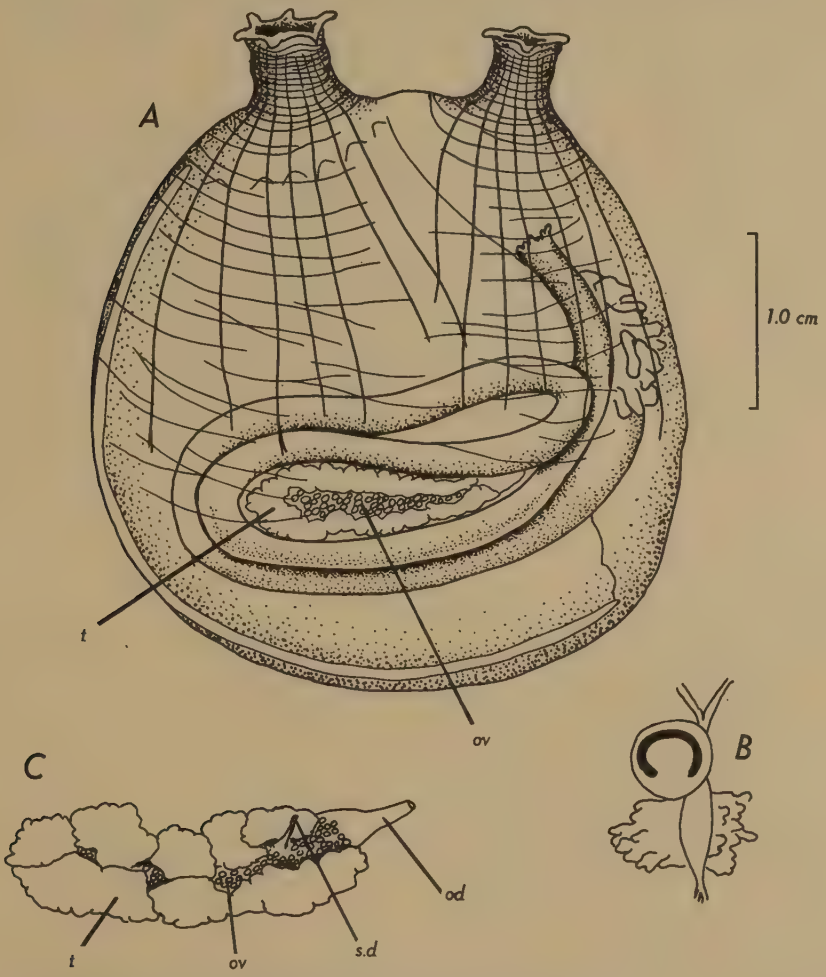
Molgula platei Hartmeyer, 1914, p. 8, figs. 2, 3.
For synonymy and remarks see van Name 1945, p. 413.

Occurrence. St. WS 742: off coast of Chile, 47–35 m.

External appearance (Pl. V, fig. 7). Many specimens are present in the collection, all taken in

a single haul. They range from 0·6 to 3·6 cm. in greatest diameter. The body is ovoid and upright, generally somewhat broader at the base, and narrower at the upper end where the siphons form two low conical papillae. But in some specimens the base is narrowed. The colour is pale grey and the surface smooth and quite soft, being free of encrusting matter, except for some at the base of the body. The animals had evidently been lying free or slightly embedded in soft bottom material. A number of animals were joined together by fusion of the test of the lower part of the body.

Test. The test is thin and flexible, but quite tough, and is almost transparent.



Text-fig. 56. *Molgula platei* Hartmeyer (St. WS 742): A, specimen removed from test; B, dorsal tubercle, with ganglion and neural gland; C, gonad.

Body wall. The body wall is also thin. Narrow but quite conspicuous longitudinal muscles pass from the siphons to about half way across the body. Circular and irregular oblique muscles are not very conspicuous or numerous on the body itself, but circular muscles are well developed round the siphons.

Tentacles. Thirteen or fourteen much branched tentacles alternate in size. Hartmeyer (1914) noted thirty-two tentacles of three sizes. The larger tentacles have four orders of branching.

Dorsal tubercle. The opening of the dorsal tubercle is C-shaped with the open interval turned backwards or back to the left (Text-fig. 56 B).

Branchial sac. On each side of the branchial sac are six folds, with the following arrangement of longitudinal bars as seen in a moderate sized animal: dorsal line 0 (5) 0 (6) 0 (8) 0 (7) 0 (6) 0 (5) 0 endostyle. Van Name (1945) wrongly quotes Hartmeyer (1914) as giving the number of bars on the folds as from two to four, whereas Hartmeyer in describing the type specimen stated that there were from two to four bars on one side of the folds. The total number would thus correspond to the number found in the 'Discovery' specimens.

Gut. The shape of the gut seems to be characteristic and affords the best means of distinguishing between this species and *M. manhattensis* (De Kay). In *M. platei* the primary loop is closed for most of its extent, as it is in the other species, but the secondary loop also is almost completely closed. About half of the intestinal loop is bent at a sharp angle to lie almost horizontally over its lower half (see Text-fig. 56A), bringing the bend of the primary loop in contact with the rectum. In *M. manhattensis* the curvature of the secondary loop is typically the arc of a circle with the opening of the loop dorsal, contrasted with the flattened horizontal secondary loop with the opening posterior, in *M. platei*.

Gonads. The left gonad lies in the secondary intestinal loop and the right gonad lies obliquely above the renal sac. (Text-fig. 56A). The central ovary (*ov.*) and fringing testis (*t*) are much as described by Hartmeyer. The oviduct (*od.*) is terminal and the sperm duct (*s.d.*) a short distance from it.

Remarks. This species has previously been known only by a single specimen from the coastal waters of Chile near Chiloe Island. Van Name (1945), while allowing the species to stand, was in some doubt whether it differed sufficiently from *M. manhattensis* to justify separation, but the plentiful material of the 'Discovery' collection confirms Hartmeyer's view that the two species are distinct.

Distribution. Coastal waters of Chile (about 38° S. to 44° S.).

Molgula malvinensis Ärnbäck (Text-fig. 57)

Molgula malvinensis Ärnbäck, 1938, p. 5, pl. 1, figs. 1–3; text-fig. 1.

Occurrence. St. 159: S. Georgia, 160 m. St. 474: S. Georgia, 199 m.

External appearance. The largest specimen measures 4·3 cm. long (antero-posteriorly) by 3·0 cm. high (dorso-ventrally) by 2·0 cm. wide and is considerably larger than specimens hitherto obtained; the smallest is 2·7 by 1·7 by 1·5 cm. The body is almost completely hidden by adhering sand and small stones, the contracted siphons alone being visible on the upper surface. Ärnbäck (1938) states that the test bears irregular hair-like processes. The test processes of the specimens in the 'Discovery' collection are either grouped together in small bunches or are compound, several hairs arising from a short common stem. At their outer ends these hairs are usually expanded, where they are attached to the small stones covering the body.

Tentacles (Text-fig. 57B). The tentacles differ somewhat from those illustrated by Ärnbäck (1938, text-fig. 1) who shows them as bi-pinnate. Van Name (1945) states that the tentacles are like those of *M. occidentalis* Traustedt, which are at least tri-pinnate. In the 'Discovery' specimens there are about eight large tentacles and the same number of very small ones. Even the large tentacles are only once pinnate and the branches, which number four or five on each side, are very short.

Dorsal tubercle (Text-fig. 57C). The dorsal tubercle has a C-shaped slit with the horns inrolled; the opening of the C faces right in one of the specimens examined and left in the other.

Branchial sac. There are, as reported by Ärnbäck, seven folds on the right side of the branchial sac and six on the left side. Longitudinal bars are distributed as follows in the largest specimen:

Left—dorsal line 1 (18) 1 (22) 1 (21) 2 (20) 2 (20) 1 (14) 0 endostyle.

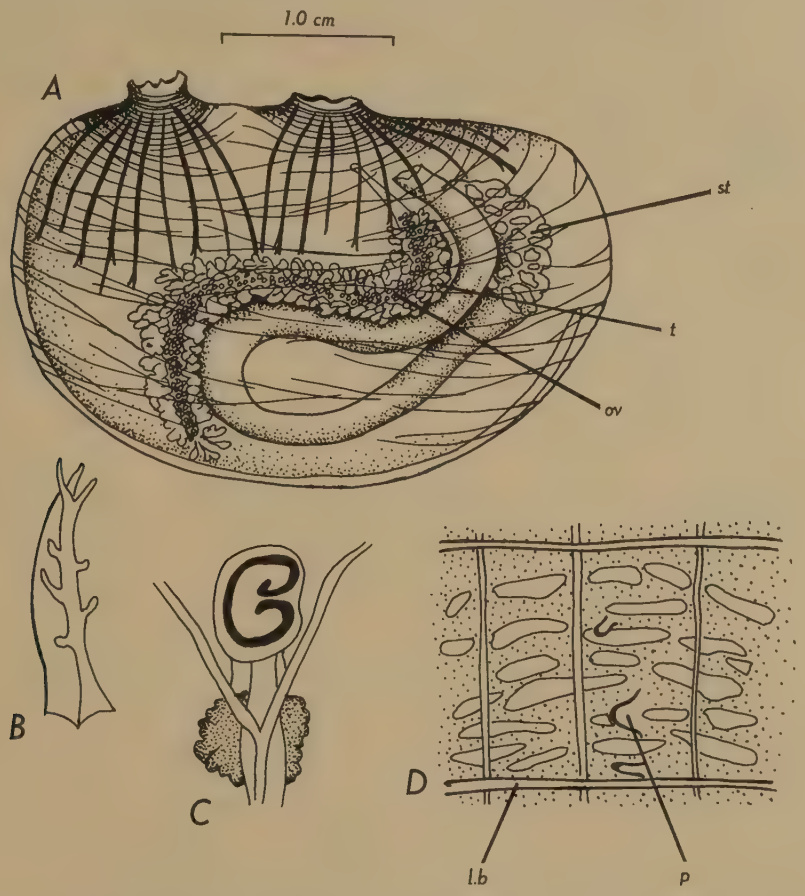
Right—dorsal line 2 (14) 1 (21) 1 (26) 1 (22) 1 (22) 1 (20) 1 (16) 0 endostyle.

In this specimen there are twice as many bars on the folds as in Ärnbäck's specimens, a fact corresponding to the greater body size. In the type specimen the edge of the dorsal lamina was toothed,

but van Name (1945) noted that it is sometimes almost smooth. In the 'Discovery' animals dissected, the lamina is distinctly toothed throughout its whole length. Small papillae were present on the branchial wall of the type specimens and a few were also seen in the 'Discovery' material (Text-fig. 57 D, *p*). They are probably the rudiments of new transverse bars.

Gut. The curvature of the secondary loop is rather less than in the type specimens.

Gonads. The position of the gonads is characteristic of the species, the left one bent round the intestinal loop (Text-fig. 57 A), and the right one bent round the renal sac. The ovary (*ov.*) is narrow and tubular, and is bordered by lobed testis follicles (*t*) along its whole length. Both oviduct and sperm duct are long and straight, and are embedded in the body wall.



Text-fig. 57. *Molgula malvinensis* Ärnbäck (St. 159): A, specimen removed from test; B, oral tentacle; C, dorsal tubercle, with ganglion and neural gland; D, part of branchial wall.

Remarks. As pointed out by van Name (1945) this species resembles *M. occidentalis* Traustedt. It is even more like *M. pyriformis* Herdman. From these two species it can be distinguished as shown in Table 36.

M. pyriformis rests on a single specimen and as the differences separating it from *M. malvinensis* are not great it might be possible to unite it with that species if more specimens could be examined from the area from which the type of *M. pyriformis* was obtained. In the meantime, however, the two species must be recognized.

Distribution. Antarctic (South Georgia, Shag Rocks; Kerguelen), Subantarctic (Falkland Islands; Macquarie Island).

Molgula bacca Herdman

Molgula bacca Herdman, 1910, p. 13, pl. 4, figs. 1–5.

Occurrence. St. 175: S. Shetlands, 200 m.

External appearance. The single specimen has a body 2·0 cm. long and stalk 0·7 cm. As in Ärnbäck's specimen from the Graham Land region the surface of the test bears very small scattered tag-like processes, which are most numerous on the siphons; they are coated with sand. The test is thin and transparent, allowing the branchial folds and the gut to be seen from the outside. The shape of the specimen is almost identical to those illustrated by Herdman (1910, pl. 4, figs. 1, 2) and by Ärnbäck (1938, text-fig. 4). It seems to be constant in the species which is characterized by (1) the pear-shaped body, (2) the short basal stalk, (3) the asymmetrically placed short siphons, and (4) the transparent test.

Body wall. The muscles of the body wall are slender and run almost entirely in a transverse direction. They are best developed on the dorsal and ventral areas of the body, and absent from the area overlying the gut.

Table 36

	M. malvinensis	*M. occidentalis*	*M. pyriformis*
Dorsal tubercle opening	C-shaped	C-shaped	Simple funnel-shaped
Primary intestinal loop	Open	Nearly closed	Widely open
Secondary intestinal loop	Bent to less than ½ circle	Bent to ¾ circle	Bent to about ½ circle
Left gonad	Extending beyond distal bend of primary intestinal loop	Barely reaching distal bend of primary intestinal loop	Extending to distal bend of primary intestinal loop
Distribution	Antarctic and Subantarctic	Warm Atlantic America and tropical W. Africa	Off Buenos Aires

Tentacles. Fourteen tentacles were counted, of which four were very large, occupying the dorsal, ventral and mid-lateral positions. The larger tentacles are much branched and at least three times pinnate.

Dorsal tubercle. The dorsal tubercle faces obliquely to the left and rear and has the horns turned inwards.

Branchial sac. Longitudinal branchial bars are arranged as follows on the left side: dorsal line 5 (12) 1 (18) 2 (18) 2 (16) 3 (13) 3 (13) 1 (12) 2 endostyle. The bars on the ventral faces of the folds are stouter than those on the dorsal faces.

I have nothing to add regarding the gut and there were no gonads in this specimen.

Distribution. Antarctic (Graham Land region, McMurdo Bay, Kaiser Wilhelm II Land).

Molgula setigera Ärnbäck f. georgiana n. (Text-fig. 58A–D)

Diagnosis of form. Differs from the typical form of the species in (1) opening of dorsal tubercle a simple longitudinal slit, (2) long bristle-like hairs of test confined to region of siphons, and (3) several sperm ducts.

Occurrence. St. 159: S. Georgia, 160 m. St. 474: S. Georgia, 199 m.

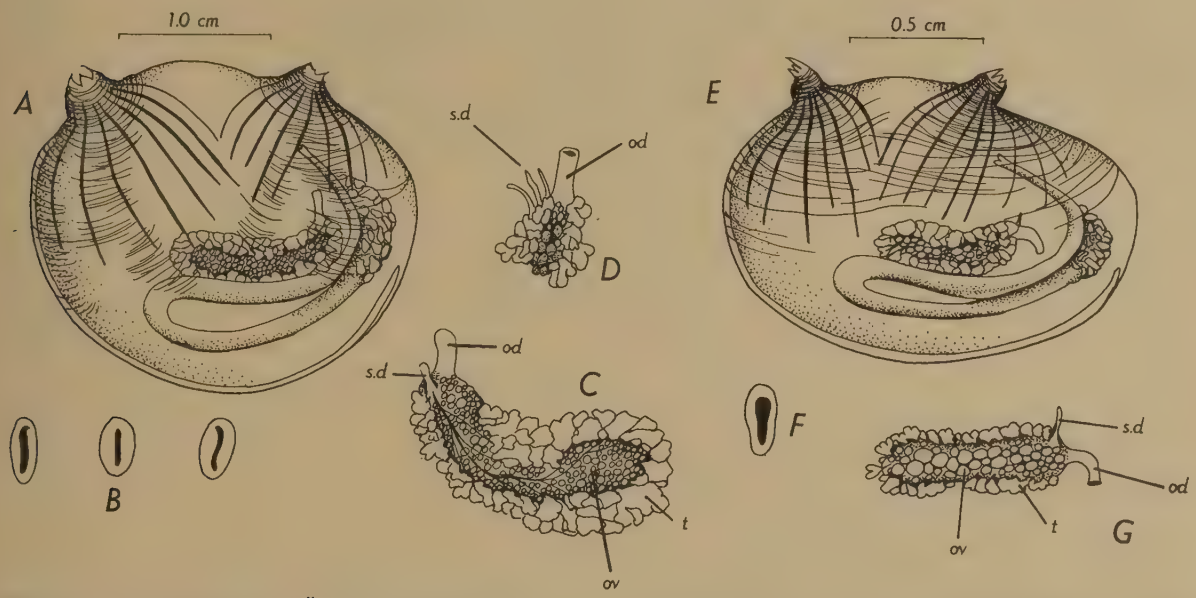
External appearance. There are five specimens of this form, varying in length from 2·5 to 2·8 cm. The shape of the body is roughly ovoid, but its outline is very irregular owing to the great amount of small stones and sand sticking to the test. Only the siphons are free of this covering. The most noticeable feature is a tuft of long stiff bristles round the opening of each siphon. In one of the type specimens of the species described by Ärnbäck (1938), bristles covered almost all the body except the ventral side, but in the others they were sparsely arranged on the sides and dense only on the siphons. In the 'Discovery' specimens the bristles are even more strictly limited to the siphons.

TENTACLES. There are twenty-two tentacles in one specimen examined. They have short branches and are at most bi-pinnate.

DORSAL TUBERCLE. The dorsal tubercle in each of four animals has a narrow longitudinal slit-like opening, either straight, slightly sinuous, or very slightly curved (Text-fig. 58 B). This is quite distinct from the C-shaped opening described by Ärnbäck in the typical form of the species.

BRANCHIAL SAC. The number of branchial folds varies; in one animal there are seven on each side and in another seven on the left and six on the right. There are six to fourteen longitudinal bars on the folds and either one bar or none, between folds.

GUT. In general shape the gut conforms to Ärnbäck's description and figure, but the upwards bend of the rectum is less acute, in the 'Discovery' specimens.



Text-fig. 58. *Molgula setigera* Ärnbäck f. *georgiana* (St. 474): A, specimen with test removed; B, dorsal tubercle; C, gonad with one sperm duct; D, part of gonad with three sperm ducts. *Molgula setigera* f. *marioni* (St. 1563): E, specimen with test removed; F, dorsal tubercle; G, gonad.

GONADS. The form of the gonads (Text-fig. 58 C, D) is fairly constant, resembling that of the type specimens, but the gonoducts are variable. Usually the oviduct (*od.*) is moderately long, but in at least one specimen is quite short; it is always directed up towards the atrial siphon. The sperm ducts (*s.d.*) vary in number and position. There may be from one to five short narrow sperm ducts near the base of the oviduct.

REMARKS. These specimens from South Georgia have certain slight but constant differences from Ärnbäck's types of *M. setigera*, and I have hesitated whether to include them in that species or to regard them as a new species. The presence of bristles only on the siphons, and the existence of several sperm ducts are perhaps minor differences, but the condition of the dorsal tubercle is a more important character. There is little doubt that the 'Discovery' material from South Georgia is taken from a genetically different population than that from the Falkland Islands on which the species was founded. However, the remarkable similarities which all the specimens have suggest a very close relationship which is perhaps best denoted by calling the South Georgia population a new form, f. *georgiana*. Should more specimens become available from either Falkland Islands or South Georgia, or from places between, it may be possible to revise the systematic position.

Molgula setigera Ärnbäck f. marioni n. (Text-fig. 58 E–G)

DIAGNOSIS OF FORM. Differs from the typical form of the species in (1) opening of dorsal tubercle a simple longitudinal oval slit, (2) long bristle-like hairs of test confined to region of siphons, and (3) oviduct turned down ventrally.

OCCURRENCE. St. 1563: Marion Island, 101–106 m.

EXTERNAL APPEARANCE. The single specimen which is almost completely covered with sand and fragments of shell is about 1·6 cm. long. Two prominent groups of bristles, up to 6 mm. long, mark the positions of the siphons. Elsewhere the body has a covering of very much more slender and flexible test hairs.

TENTACLES. There are sixteen bi-pinnate tentacles of various sizes.

DORSAL TUBERCLE. The dorsal tubercle has a longitudinal oval opening (Text-fig. 58 F), quite unlike that of the type specimens of *M. setigera*.

BRANCHIAL SAC. The seven folds on each side of the branchial sac have each from three to ten longitudinal bars, the smallest number being on the most ventral fold. There are no bars between folds.

GUT. No differences were seen between the gut of f. *marioni* and f. *georgiana*.

GONADS. The gonads have the same structure as in the typical form but differ in the downward bend of the short oviduct, which is directed ventrally away from the atrial siphon (Text-fig. 58 G, *od.*).

REMARKS. This specimen is clearly related to the specimens from South Georgia representing f. *georgiana* and the typical form of the species from Falkland Islands. But just as clearly it differs, and the degree of difference is best recognized by placing the specimen in a separate form, f. *marioni*.

If my interpretation of the 'Discovery' material is right *M. setigera* presents an interesting case of a species breaking up into separate populations, each inhabiting its own restricted area, and each having slight but constant anatomical differences. Working with preserved material, it is impossible to say whether these isolated populations, in the areas of Falkland Islands, South Georgia and Marion Island respectively, have yet attained complete genetic, as well as geographical, isolation. If it could be shown that they have, then the populations would have to be recognized as separate species, instead of forms.

M. setigera, it has been suggested (van Name, 1945), might prove to be synonymous with *M. kophameli* Michaelsen, from the Strait of Magellan. The two species are similar but the complete absence of bristles in *M. kophameli* does not support the suggestion.

I believe that Kott's (1954) record of *M. setigera* from Enderby Land probably refers to a different species. These Antarctic specimens have, judging from Kott's account, certain features which do not agree with *M. setigera*. The position of the gonads seems to be different, since they diverge from the intestinal loop and the renal sac, whereas in *M. setigera* they are close and parallel to those organs. Also it is not clear if stiff bristles are present on the test.

DISTRIBUTION (of species including forms). Subantarctic (Falkland Islands, Marion Island), Antarctic (South Georgia).

Molgula sabulosa (Quoy & Gaimard) (Text-fig. 59)

Ascidia sabulosa Quoy & Gaimard, 1834, p. 613, pl. 91, figs. 19–22.
Molgula forbesi Herdman, 1881, p. 236.
Molgula sabulosa Kott, 1952, p. 298, figs. 166–8.

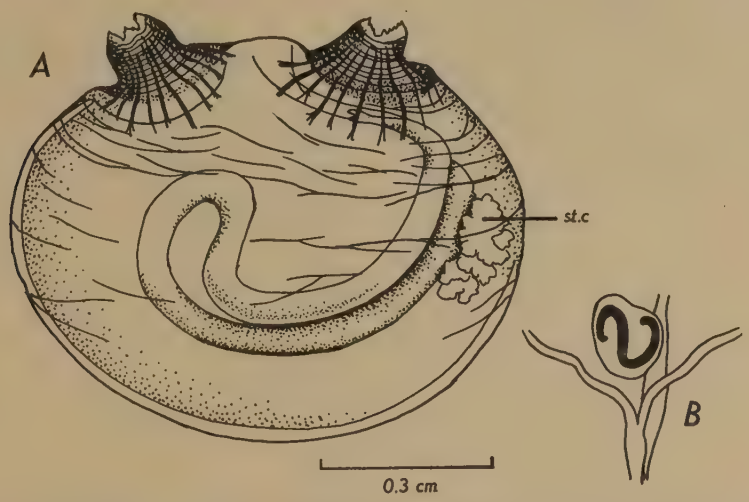
OCCURRENCE. St. 1686: Victoria, Australia, 0 m.

EXTERNAL APPEARANCE. There is only one specimen, and this measures 1 by 1 cm. The body is

roughly ovoid with the upper surface slightly flattened, and the two short conical siphons situated fairly close together on the flat portion. The sides of the body are also flattened. Short processes of the test are present on the dorsal flattened area, and also along the mid-ventral line. A light coat of sand covers the whole surface of the body.

Body wall. Both the test and body wall are quite thin. The internal siphons are conical with toothed borders and prominent radial muscles. Radial longitudinal muscles also pass across the sides of the body, and generally are fewer on the left side than on the right.

Tentacles. There are twelve quite large pinnate tentacles and, alternating with them, about the same number of very small tentacles.



Text-fig. 59. *Molgula sabulosa* (Quoy and Gaimard): A, specimen with test removed; B, dorsal tubercle.

Dorsal tubercle. The dorsal tubercle has a characteristic horizontal S-shaped slit (Text-fig. 59B) as described by Herdman (1882) and Kott (1952).

Branchial sac. In the branchial sac there are seven folds on each side, each fold with about six longitudinal bars. There are no bars between the folds.

Gut. The oesophagus is short and the stomach has a group of short rounded caeca (*st.c.*). The primary intestinal loop is almost closed except at its anterior bend where the limbs are slightly separated. The secondary loop is a flat horizontal semicircle or crescent, with the opening dorsal.

Gonads. No gonads were found in this specimen.

Renal sac. The renal sac is gently curved and is not very large.

Remarks. Kott (1952, 1954) united *M. sabulosa* with *M. pedunculata*, but in spite of certain similarities the species are distinct, as shown in Table 37.

Table 37

	M. sabulosa	*M. pedunculata*
Test processes	Present	Present
Tentacles	12 large and 12 small	12–20
Dorsal tubercle opening	Horizontal S	C-shaped, facing backwards; both horns inrolled
Branchial sac	7 folds; 3–6 bars per fold; 0–1 bar between folds	7 folds; 6–13 bars per fold; 1–4 bars between folds
Gonads	Testis massed at lower, blind, end of ovary	Testis along whole length of ovary
Distribution	S. Australia–Indonesia	Antarctic

Of these characters the shape of the opening on the dorsal tubercle in itself is enough to separate the two species.

The specimen from Enderby Land, which Kott (1954) provisionally identified as *M. sabulosa* does not seem to be this species, but may be *M. pedunculata*.

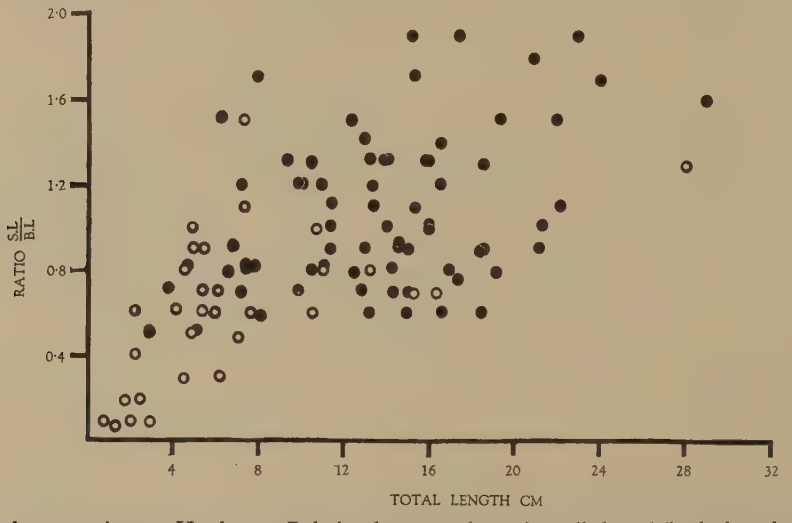
DISTRIBUTION. Southern Australia; Indonesia.

Genus Ascopera Herdman, 1881

Ascopera gigantea Herdman (Text-figs. 60–62; Pl. VI, figs. 1, 2)

Ascopera gigantea Herdman, 1881, p. 238.
Ascopera pedunculata Herdman, 1881, p. 239.
?*Ascopera bouvetensis* Michaelsen, 1904, p. 188.

OCCURRENCE. St. 39: S. Georgia, 179–235 m. St. 42: S. Georgia, 120–204 m. St. 45: S. Georgia, 238–270 m. St. 123: S. Georgia, 230–250 m. St. 140: S. Georgia, 122–136 m. St. 152: S. Georgia,



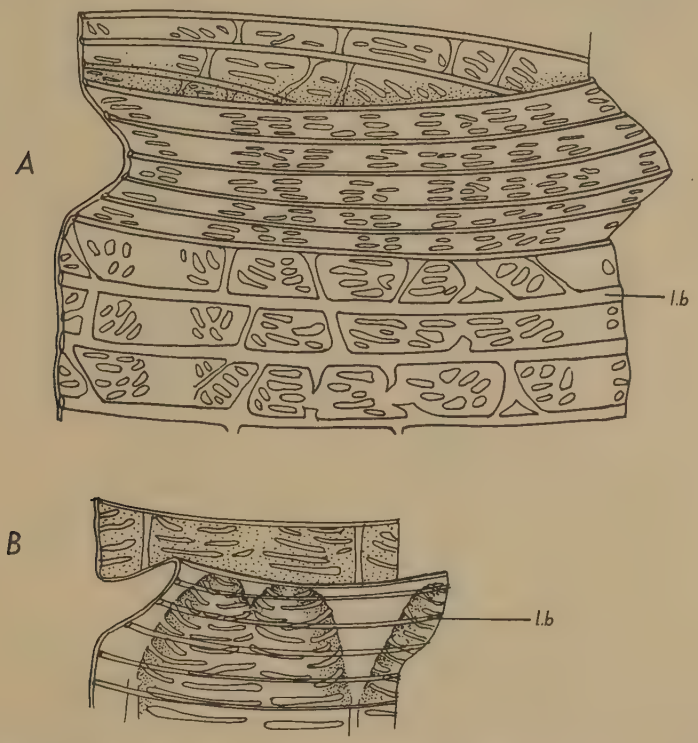
Text-fig. 60. *Ascopera gigantea* Herdman. Relation between the ratio stalk-length/body-length and the total length, in specimens from the S. Sandwich Islands (○) and from S. Georgia (●).

245 m. St. 156: S. Georgia, 200–236 m. St. 159: S. Georgia, 160 m. St. 195: S. Shetlands, 391 m. St. 366: S. Sandwich Islands, 155–322 m. St. 371: S. Sandwich Islands, 99–161 m. St. 1873: Scotia Sea, 210–180 m. St. MS 68: S. Georgia, 220–247 m. St. Deception Islands, S. Shetlands, 25–30 m.

EXTERNAL APPEARANCE AND THE POSSIBLE SEPARATION OF *A. GIGANTEA* AND *A. PEDUNCULATA*. The smallest specimen has a total length of 0·9 cm. and the largest one 28·0 cm. The shape of the body has already been well described (Herdman, 1882; Hartmeyer, 1911; Ärnbäck, 1938), but as it was the main reason for originally separating the species *A. gigantea* and *A. pedunculata*, I shall deal with it in some detail. According to Herdman (1882) the ratio length of stalk to length of body in *A. gigantea* was 1:2 and in *A. pedunculata* about 2·4:1. Text-fig. 60 shows the ratio of stalk length to body length plotted against total length, for all specimens in the 'Discovery' collection from the two areas which yielded most of the material: South Sandwich Islands, and South Georgia. There is a tendency for the smallest specimens to have a relatively shorter stalk, but in specimens over 4 or 5 cm. the correlation between total length and the ratio of stalk to body is weak. Inspection of Text-fig. 60 suggests that the populations from the South Sandwich Islands and South Georgia cannot be separated by a

difference in the ratio of stalk to body. This is confirmed by using the coefficient of difference (Mayr, Linsley & Usinger, 1953) to determine how far this character overlaps in the two populations. The level of distinctness of the populations is much below that conventionally recognized as subspecific.[1] It is therefore clear that *Ascopera*, as represented in the rich 'Discovery' material, cannot be separated into two species or even geographical forms. I therefore agree with van Name (1945) that *A. pedunculata* is a synonym of *A. gigantea*.

Branchial sac. The irregularity of the stigmata and transverse vessels (Text-fig. 61 A) has been stressed in descriptions of *Ascopera*, but in some specimens, especially young ones, the typical molgulid arrangement of spiral stigmata is readily seen (Text-fig. 61 B). There is also, in small animals, less irregularity in the vessels, many of which are still transverse and unbranched. As in



Text-fig. 61. *Ascopera gigantea* Herdman (St. 371): A, part of the branchial wall of a large specimen; B, of a small specimen.

other molgulids, too, the stigmata form infundibula, which rise into the branchial folds to form pouches. Longitudinal bars have the following arrangement in two specimens of moderate size:

(1) dorsal line—5 (12) 3 (8) 7 (7) 4 (9) 6 (9) 8 (5) 6 (9) 3 endostyle.

(2) dorsal line—4 (9) 1 (16) 4 (14) 3 (11) 6 (13) 6 (7) 2 (8) 2 endostyle.

Gut. Yellow glandular tissue on the surface of the stomach extends down each side of the intestine for some distance (Text-fig. 62 A, *gl.*).

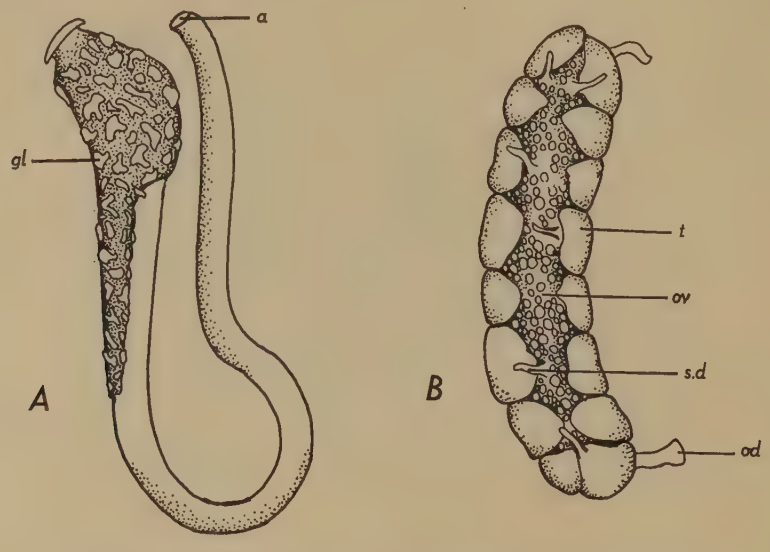
Gonads (Text-fig. 62 B). The gonads are long sausage-shaped bodies, each with a central ovary (*ov.*) extending the whole length of the gonad, and a series of testis lobes (*t*) arranged along the sides of the ovary. One terminal oviduct (*od.*) is normally present, pointing towards the atrial siphon, but

[1] Coefficient of distinctness of two populations A and $B = \dfrac{\text{mean}_A - \text{mean}_B}{\text{standard deviation}_A - \text{standard deviation}_B}$. Here the coefficient of distinctness $= \dfrac{1{\cdot}1 - 0{\cdot}6}{0{\cdot}3742 + 0{\cdot}3755} = 0{\cdot}667$, which is much below the conventional level for subspecific distinctness (1·28).

occasionally there is an additional oviduct, at the other end of the gonad. About six short sperm ducts (*s.d.*) are scattered along the mesial surface of the gonad.

Remarks. As I have stated above I see no reason to distinguish between Herdman's two species of *Ascopera*, and the name *A. gigantea* has priority. Michaelsen (1904) described a new species *A. bouvetensis* from three small specimens collected at Bouvet Island. It is very likely that this species should also be referred to *A. gigantea*, from which it seems to differ in nothing but size.

Distribution. Antarctic (Kaiser Wilhelm II Land, Graham region, South Sandwich Islands, South Shetlands, South Georgia, Kerguelen, ?Bouvet Island).



Text-fig. 62. *Ascopera gigantea* Herdman (St. 371): A, gut; B, gonad.

Genus **Paramolgula** Traustedt, 1885

Paramolgula gregaria (Lesson) (Text-fig. 63, Pl. V fig. 2)

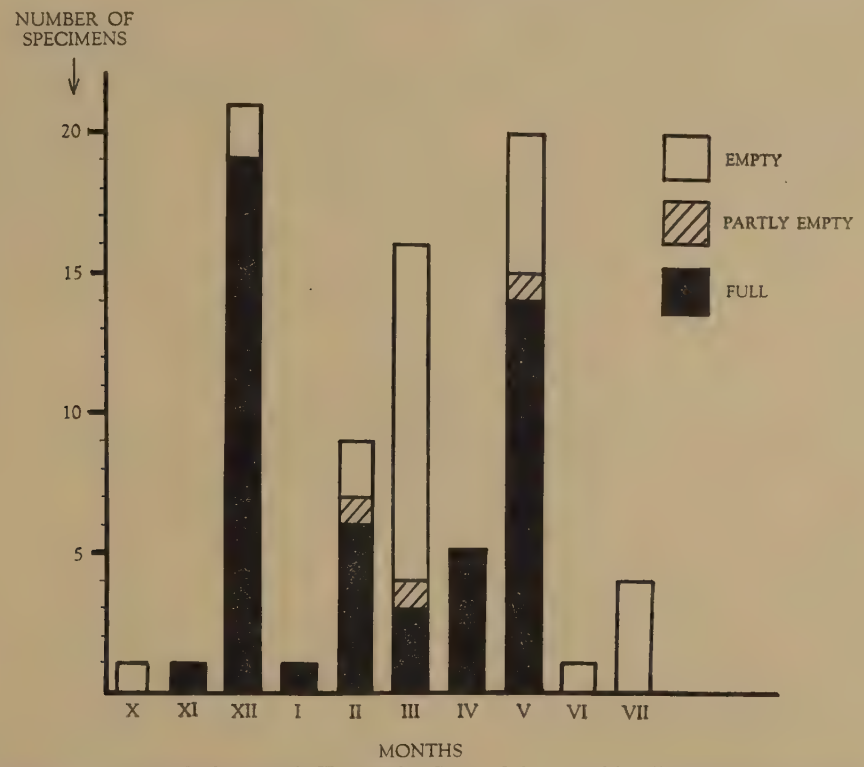
Cynthia gregaria Lesson, 1830, p. 157, pl. 52, fig. 3.
For synonymy see van Name (1945), p. 428.

Occurrence. St. 51: Falkland Islands, 115 m. St. 52: Falkland Islands, 17 m. St. 53: Falkland Islands, 0–2 m. St. 55: Falkland Islands, 10–16 m. St. 56: Falkland Islands, 10·5–10 m. St. 57: Falkland Islands, 15 m. St. 58: Falkland Islands, 1–2 m. St. 1230: Magellan Strait, 27 m. St. 1902: Patagonian Shelf, 50–80 m. St. WS 71: Falkland Islands, 82–80 m. St. WS 72: Falkland Islands, 95 m. St. WS 73: Falkland Islands, 121–130 m. St. WS 79: Patagonian Shelf, 132–131 m. St. WS 88: Patagonian Shelf, 118 m. St. WS 89: Patagonian Shelf, 23–21 m. St. WS 210: Falkland Islands, 161 m. St. WS 222: Patagonian Shelf, 100–106 m. St. WS 243: Patagonian Shelf, 144–141 m. St. WS 756: Falkland Islands, 119–104 m. St. WS 776: Patagonian Shelf, 110–99 m. St. WS 781: Patagonian Shelf, 148 m. St. WS 782: Patagonian Shelf, 141–146 m. St. WS 784: Patagonian Shelf, 170–164 m. St. WS 791: Patagonian Shelf, 97–95 m. St. WS 796: Patagonian Shelf, 108–112 m. St. WS 797: Patagonian Shelf, 115–111 m. St. WS 798: Patagonian Shelf, 49–66 m. St. WS 808: Patagonian Shelf, 110–106 m. St. WS 823: Patagonian Shelf, 80–95 m. St. WS 834: Patagonian Shelf, 27–38 m. St. WS 847: Patagonian Shelf, 57–84 m. St. WS 849: Patagonian Shelf, 137 m. St. WS 861: Patagonian Shelf, 117–124 m. St. WS 863: Patagonian Shelf, 121–117 m. St. WS 864: Patagonian Shelf, 128–126 m. St. MS 71: S. Georgia, 110–60 m.

External appearance. This well-known species requires little additional description as regards external form. The smallest specimen in the collection is 1·1 cm. long and the largest 23·0 cm. Several specimens give no evidence of attachment other than the presence of sand on the test, but in some a number of small pebbles are embedded in the test of the lower part of the body, suggesting that in life these animals were thus anchored to the bottom.

Internal structure. This also has been well described by a number of authors (see especially van Name, 1945). The individual variation in the branchial sac, intestinal curvature, and position of the left gonad in the species are such as to include the characteristics of form *capax* Ärnbäck (1938).

Biology. (*a*) *Breeding*. The annual breeding cycle has been determined by examining all specimens and estimating the state of the gonad, which has been classified as 'full', 'spawning' or 'empty'.



Text-fig. 63. *Paramolgula gregaria* Traustedt. State of the gonad in all specimens, in all years, in relation to the month of the year.

These groupings refer to the ovary; 'spawning' means that an appreciable quantity of eggs has been shed from the ovary and the specimen has evidently been taken during its female-spawning period. Animals under about 3 cm. have not been included as they had not yet attained sexual maturity. Text-fig. 63 shows the reproductive state of all animals over 3 cm. long. It seems that most of the spawning takes place in the months of February to May, that the animals are spent during the southern winter, and that the gonad becomes active again in November. No material was available from the months of August and September.

(*b*) *Food*. Specimens were examined from material collected at different times of the year. In all of these there was food in the gut, and at all seasons the food consisted largely of unicellular planktonic algae, mainly under 20 μ in diameter. Diatoms were also present, but less abundant. Occasionally parts of crustacea (amphipods and copepods) were found, and it seemed that these were either alive or

recently dead when ingested by the ascidian as the guts of the crustaceans contained recognizable food particles. Inorganic particles, mainly sand grains, were found in only a few specimens and never in great quantity. The food of this ascidian can therefore be said to be principally live plankton rather than organic debris.

Remarks. The record from St. MS 71 is interesting as it extends the known range of the species as far as South Georgia.

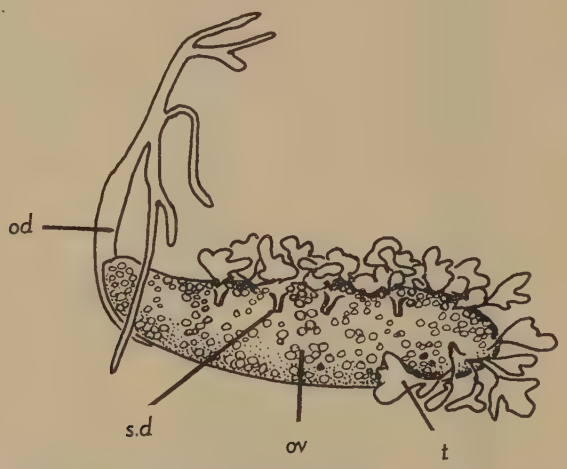
Distribution. Antarctic (South Georgia), Subantarctic (Falkland Islands, Patagonian Shelf, Magellan region, coast of Chile).

Genus **Eugyra** Alder & Hancock, 1870

Eugyra kerguelenensis Herdman (Text-fig. 64)

Eugyra kerguelenensis Herdman, 1881, p. 237.
For synonymy see Kott (1954), p. 139.

Occurrence. St. 1941: S. Georgia, 38 m. St. WS 854: Patagonian Shelf, 97 m. St. WS 856: Patagonian Shelf, 104 m.



Text-fig. 64. *Eugyra kerguelenensis* Herdman (St. 1941): Gonad.

External appearance. The largest specimens are those from the Patagonian Shelf, which reach a greatest diameter of 20 mm. These equal in size the largest yet found, which were described from Kerguelen by Kott (1954). The specimens from South Georgia in the 'Discovery' collections range from 8 to 18 mm. In all specimens the surface of the body has a coat, sometimes not very thick, of moderately long, unbranched hairs to which sand and mud adheres. The body is ovoid to globular. There is generally a sunken area round the siphons, sometimes with four grooves running from its corners as described by van Name (1945).

Body wall. Muscles, both longitudinal and circular, are best developed on and near the siphons. There is, in addition, a narrow row of transverse fibres overlying the endostyle, as already described by other authors, but I have found this band to continue in some specimens across the dorsal part of the body and down its posterior surface.

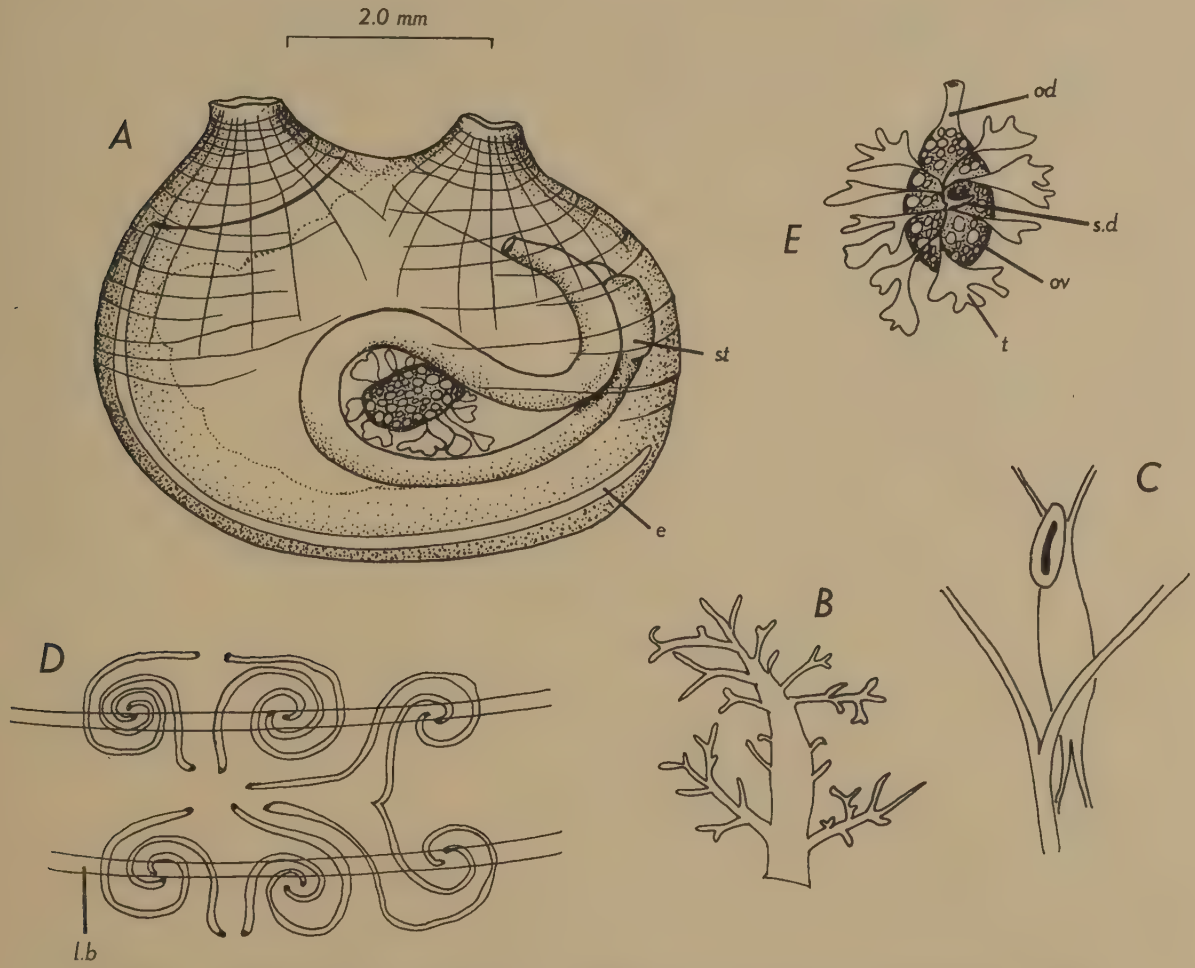
Tentacles. The oral tentacles usually number only ten to thirteen, even in quite large specimens.

Dorsal tubercle. Van Name (1945) shows and describes the dorsal tubercle as having an 'almost completely closed ring-like opening', but the 'Discovery' animals have a more nearly C-shaped or crescentic slit.

Branchial sac. The branchial sac does not differ from previous accounts.

Gonads. The form of the gonads is not exactly that described by Hartmeyer (1912), who stated that the testis follicles are arranged in a complete ring round the ovary. Instead I find that the testis follicles (Text-fig. 64, *t*) are generally confined to the dorsal side and the anterior end of the ovary (*ov.*). In some specimens the oviduct is simple, short and terminal, but in a few of those from South Georgia it is branched in an antler-like fashion (*od.*). I do not know if all the branches have openings. The male openings are on about five small sperm ducts (*s.d.*) arranged along the dorsal margin of the gonad.

Distribution. Antarctic (Kerguelen, South Georgia), Subantarctic (off coast of Argentina).



Text-fig. 65. *Eugyra brewinae* sp.n. (St. 936): A, specimen with test removed; B, oral tentacle; C, dorsal tubercle and ganglion; D, part of branchial wall; E, gonad.

Eugyra brewinae sp.n. (Text-fig. 65)

Holotype. Size: 5 mm. diameter.

Diagnosis of species. Body small and covered with sand. Test and body wall very thin and transparent. Dorsal tubercle a simple longitudinal slit. Branchial sac with six longitudinal bars on each side. Stigmata in regular double spirals. Gonad on left side only, within primary intestinal loop, consisting of central ovary and radially arranged, branched testis-lobes. Renal sac small, close to stomach.

Occurrence. St. 936: North Island, New Zealand, 50–57 m.

External appearance. The specimens are ovoid, and have a greatest diameter ranging from 3 to 6 mm. A complete covering of sand conceals the body, and, at least in the preserved state, no siphons are visible externally.

Test. The test is very thin, flexible and transparent, when the coat of sand grains has been removed.

Body wall. The body wall also is thin and has narrow muscles, consisting of circular strands mainly on the upper half of the body, and longitudinal strands radiating from the siphons and extending about half way across the body.

Tentacles. There are ten to twelve tentacles of at least two sizes, the larger ones being tri-pinnate and quite bushy (Text-fig. 65 B).

Dorsal tubercle. The dorsal tubercle, which lies below the anterior end of the ganglion, is small with a simple longitudinal slit, either straight or very slightly curved (Text-fig. 65 C).

Branchial sac. In the branchial sac there are six longitudinal bars, more closely spaced in the dorsal part of the sac, but no folds. Below each bar lies a longitudinal row of infundibula, and in addition there are a few infundibula between the dorsal bar and the dorsal lamina, and a few between the ventral bar and the endostyle, in each case at the antrior end of the branchial sac. The infundibula project only very slightly from the surface of the branchial wall. Each infundibulum consists of two parallel spiral stigmata (Text-fig. 65 D). The dorsal lamina is a plain narrow membrane.

Gut. The oesophagus is short and leads to the small barrel-shaped stomach (Text-fig. 65 A, *st.*) which is scarcely wider than the intestine. The proximal part of the intestine is horizontal, and the distal part together with the rectum make an S-shaped bend, leaving an open area at the bend of the primary loop in which the single gonad is accommodated. The anus has a plain margin.

Gonad. The gonad consists of a central sac-shaped ovary (Text-fig. 65 E, *ov.*) with, applied to its mesial side, a radially arranged group of eight to eleven testis lobes (*t*). These lobes are slightly branched and may project far enough from the sides of the ovary to lie against the surface of the intestine. The oviduct (*od.*) is short and projects upwards towards the atrial siphon. A single short sperm duct (*s.d.*) is placed centrally within the rosette of testis lobes.

Renal sac. The renal sac is small but quite conspicuous owing to its almost white colour. It lies close against the stomach, on its postero-ventral side.

Remarks. This small sand-covered species, which could easily be overlooked, does not seem to have been found or recognized in previous collections.

Distribution. North end of North Island, New Zealand.

Eugyra ärnbäckae sp.n. (Text-fig. 66; Pl. IV, fig. 3, Pl. VI, fig. 6, 7)

Holotype. Size: body 12 mm., stalk, 100 mm.

Diagnosis of species. Body with a long slender stalk, arising near the oral siphon. Tentacles about sixteen, slightly branched. Dorsal tubercle with a simple longitudinal or oblique opening. Branchial sac with seven longitudinal bars on each side. Stigmata in double spirals. Right gonad above renal sac; left gonad in secondary intestinal loop.

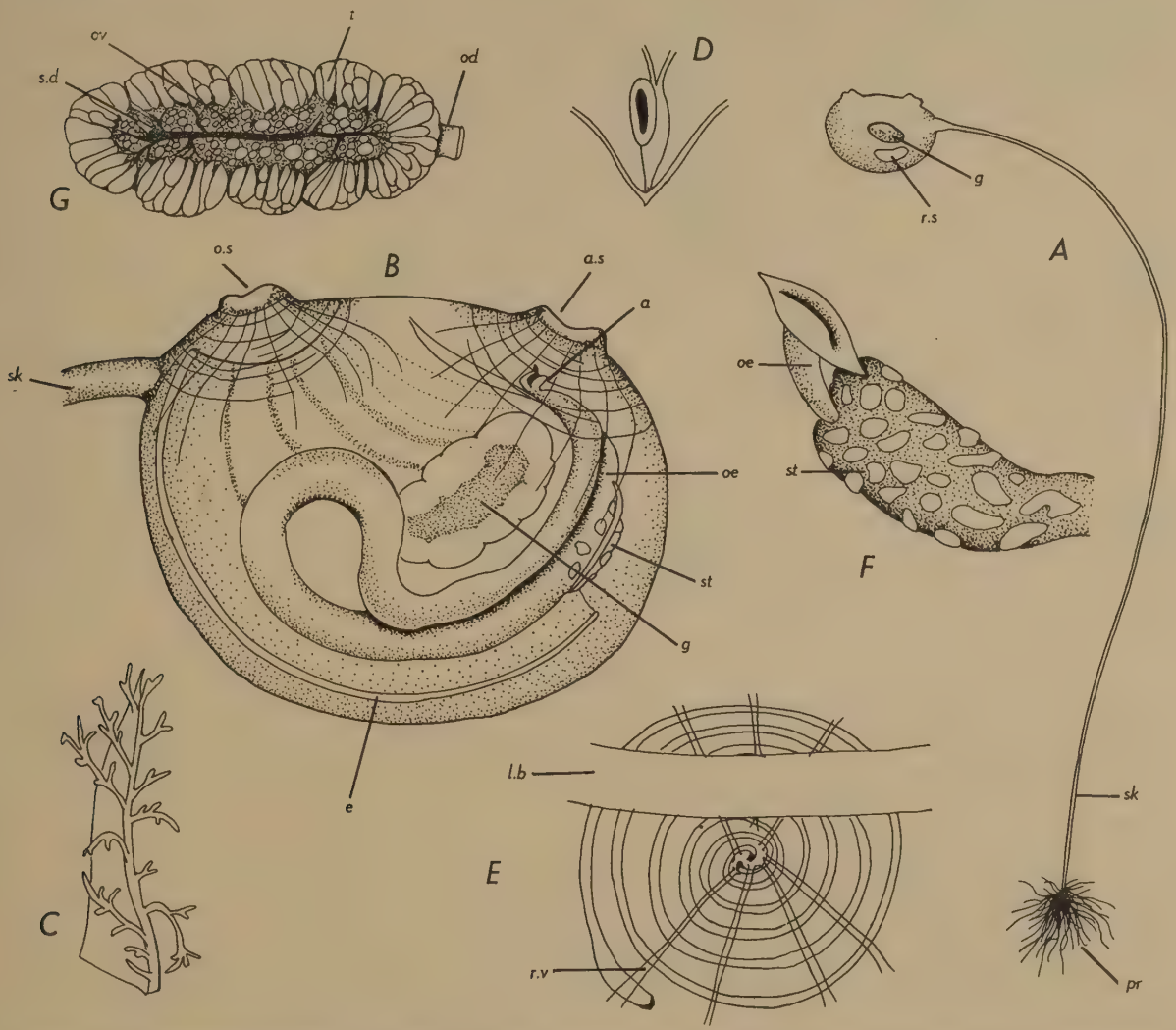
Occurrence. St. 366: S. Sandwich Islands, 155–322 m.

External appearance (Text-fig. 66 A, B; Pl. IV, fig. 3). The body is small and ovoid with the low conical siphons situated far apart on the dorsal side. A long and very slender stalk (Text-fig. 66 B, *sk.*) arises from the anterior end of the body, a little below the oral siphon (*o.s.*). The lengths of body and stalk of six specimens are:

Body length (mm.)	12	10	9	8	8	7
Stalk length (mm.)	95	75	92	87	65	62

The stalk is of nearly uniform diameter down to its lower end, where it bears a dense tuft of hair-like processes. A few sand particles adhere to the body and to the basal test-hairs of the stalk. The test of the body is very thin and almost completely transparent.

Body wall. The body wall is very thin, with slender muscles, which are mainly circular strands concentrated round the siphons. A few longitudinal strands radiate from the siphons across the sides of the body.



Text-fig. 66. *Eugyra ärnbäckae* sp.n. (St. 366): A, intact specimen from the right; B, body from the left; C, oral tentacle; D, dorsal tubercle; E, a stigma; F, stomach; G, gonad.

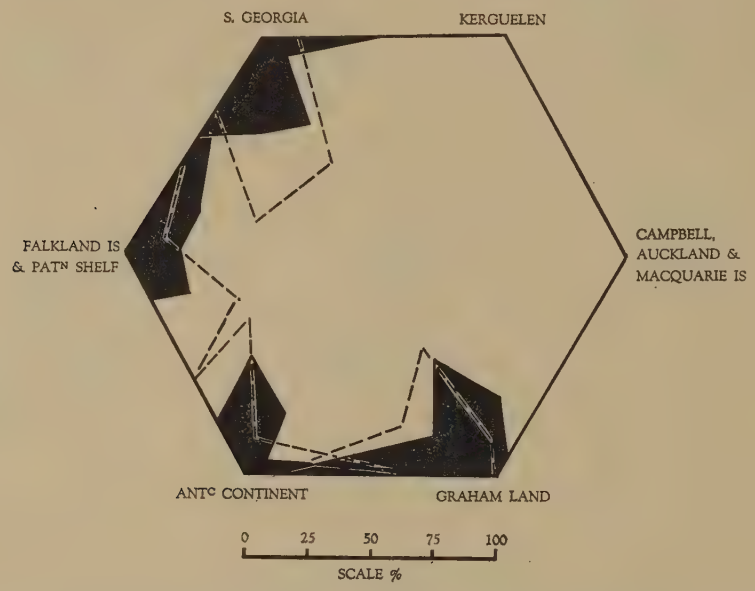
Tentacles. There are eight large oral tentacles (Text-fig. 66C) and eight smaller ones alternating with them, and sometimes a few still smaller ones can be seen. The tentacles have a stout tapering stem, a few primary branches and some short secondary branches.

Dorsal tubercle. The dorsal tubercle is small with a straight or slightly curved slit placed in a longitudinal or oblique direction (Text-fig. 66D). The dorsal tubercle covers the anterior part of the small ganglion.

Branchial sac. There are no folds in the branchial sac, which has on each side seven tall longitudinal bars. Under each longitudinal bar is a row of flat stigmata (Text-fig. 66E). The stigmata are

arranged in double spirals meeting at the centre, the total number of turns being six or seven in large stigmata. Some stigmata form unbroken spirals but others are broken at intervals. Radial vessels (*r.v.*) numbering up to about twelve originate at the centre of each stigma, some of them passing dorsally and some ventrally to join the corresponding vessels of the adjacent stigmata. The dorsal lamina has an undivided border and becomes gradually wider towards the posterior end of the branchial sac.

Gut. The oesophagus is short and curved (Text-fig. 66B, F, *oe.*), and the stomach (*st.*) wider than the rest of the gut and about twice as long as wide. Its surface is marked with many low rounded swellings. The intestinal loop is open only at its distal part. The rectum bends upwards and forwards to end below the atrial siphon. The anus (*a.*) has a two-lipped opening.



Text-fig. 67. Affinities of ascidian faunas in the Discovery Collections. Four of the corners of the figure represent the four faunal areas: 1, Antarctic Continent; 2, Graham Land; 3, S. Georgia and 4, the Falkland Islands and the Patagonian Shelf. In each area the percentage of species found also in the other areas is indicated by the height of the peak pointing to the other area. Black polygons represent ascidian species. Clear polygons enclosed by broken lines represent sponge species and are based on figures given by Burton (1932).

Gonads. There is one gonad on each side of the body, that of the left side lying a little dorsal to the gut, in the secondary intestinal loop. The right gonad (Text-fig. 66A, *g*) lies dorsal to the renal sac. Each gonad (Text-fig. 66G) is sausage-shaped or ovoid and consists of the ovary (*ov.*) extending the whole length of the gonad, and the testis (*t.*) in the form of groups of follicles arranged round the sides and ends of the ovary. There is a single short terminal oviduct (*od.*) and usually two male openings on short tubes (*s.d.*), arising from the mesial face of the gonad.

Renal sac. The renal sac is a short slightly curved body on the lower half of the right side (Text-fig. 66A, *r.s.*).

Feeding mechanism. The branchial sac contains a mixture of sand grains, small inorganic particles, whole and broken diatoms and small algal cells (Pl. VI, fig. 6). Sand grains and most of the other inorganic particles are, however, absent from the stomach and intestine (Pl. VI, fig. 7) indicating that there is some sorting mechanism. The mechanism is probably in the oesophagus which appears to accept food particles and reject sand grains and other particles not of food value. The nature of this mechanism is unknown, and its operation does not seem to depend solely on the size of the particles, because diatoms are accepted which are as large as the sand grains that are rejected. Possibly the

angular outline or the inorganic nature of the sand grains allows them to be detected and prevented from passing to the stomach.

Remarks. This new species does not fit readily into any of the existing genera of the Molgulidae. It is, however, in fairly good agreement with *Eugyra* as defined by Michaelsen (1915), Hartmeyer (1923) and van Name (1945) differing principally in (1) the flat instead of conical stigmata, and (2) the position of the left gonad in the secondary instead of the primary gut-loop. The structure of the branchial sac is in general that of a *Eugyra*. Characteristically *Eugyra* has the left gonad within the primary gut loop, but in some species it is only partially within the loop. The condition in *E. ärnbäckae* therefore represents a further stage in the shifting of the gonad out of the primary loop. The possession of a stalk, while not common in the genus, is known also in the Arctic species *E. pedunculata* Traustedt.

Distribution. Antarctic (South Sandwich Islands).

GEOGRAPHICAL DISTRIBUTION

The ascidians have certain biological similarities to the sponges, particularly the sessile habit of the adult, and the short pelagic life of the larva which lasts for about a day in both groups. These are two characters greatly influencing the geographical spread of species, and it is therefore of interest to analyse the distribution of the ascidians in the same way as Burton (1932) has done for the Antarctic sponges. Table 38 gives the geographical distribution of all the ascidian species identified in the 'Discovery' collections.

The three main Antarctic and Subantarctic areas in which ascidians were collected are (1) the Graham Land region, (2) South Georgia, and (3) the Falkland Islands and Patagonian Shelf. For each of these areas and also for the remaining part of the Antarctic continent, I have shown below the numbers of species which are also found in the other principal Antarctic and Subantarctic regions:

Antarctic continent, excluding Graham Land region, number of species		23
Of these, number also at	Graham Land	20
	S. Georgia	11
	Falkland Islands and Patagonian Shelf	5
	Kerguelen	6
	Campbell, Auckland and Macquarie Islands	2
Graham Land region, number of species		23
Of these, number also at	Antarctic continent excluding Graham Land region	20
	South Georgia	12
	Falkland Islands and Patagonian Shelf	7
	Kerguelen	7
	Campbell, Auckland and Macquarie Islands	2
South Georgia, number of species		32
Of these, number also at	Antarctic continent excluding Graham Land	12
	Graham Land	12
	Falkland Islands and Patagonian Shelf	15
	Kerguelen	14
	Campbell, Auckland and Macquarie Islands	3
Falkland Islands and *Patagonian Shelf*, number of species		24
Of these, number also at	Antarctic continent excluding Graham Land region	5
	Graham Land	7
	South Georgia	15
	Kerguelen	8
	Campbell, Auckland and Macquarie Islands	5

Table 38. *Distribution of species*

Species	*Antarctic Continent (excluding Graham Land)*	*Graham Land*	*South Shetlands*	*South Orkneys*	*South Georgia and Shag Rocks*	*South Sandwich Islands*	*Falkland Islands and Patagonian Shelf*	*Magellan region and Tierra del Fuego*	*Kerguelen*	*Campbell, Auckland and Macquarie Islands*	*New Zealand*	*Further distribution*
Aplidium circumvolutum	.	+	+	.	?+	.	+	.	+	.	+	.
A. fuegiense	.	.	.	.	+	.	+	+	.	.	.	.
A. variabile	.	.	.	.	+	.	+	.	+	.	.	.
A. falklandicum sp.n.	.	+	.	+	+	.	+	.	.	.	.	.
A. radiatum	+	+	.	+	+	.	.	.	.	.	.	.
A. caeruleum	+	+	+	.	.	.	.	.	.	.	.	?Marion Island
A. stanleyi sp.n.	.	.	.	.	.	.	+	.	.	.	.	.
A. quadrisculcatum sp.n.	.	.	.	.	.	.	.	.	.	.	+	.
A. seeligeri sp.n.	.	.	.	.	.	.	.	.	.	.	+	.
Synoicum adareanum	+	+	+	.	+	.	.	.	+	.	.	.
S. georgianum	.	.	.	.	+	.	+	.	.	.	.	.
S. giardi	.	.	.	.	+	.	.	.	+	.	.	.
S. kuranui	.	.	.	.	.	.	.	.	.	.	+	.
Aplidiopsis discoveryi sp.n.	.	.	.	.	.	.	.	.	.	.	+	.
Protopolyclinum pedunculatum sp.n.	.	.	.	.	.	.	.	.	.	.	+	.
Ritterella vestita sp.n.	.	.	.	.	.	.	.	.	.	.	+	.
Didemnum studeri	.	.	.	.	+	.	+	+	+	+	.	Stewart Island, Tasmania, Gough Island
D. biglans	+	+	.	.	.	.	.	.	.	.	.	.
D. trivolutum sp.n.	.	.	.	.	.	.	+	.	.	.	.	.
Leptoclinides diemenensis	.	.	.	.	.	.	.	.	.	.	+	.
Tridemnum auriculatum	.	.	.	.	.	.	+	+	.	.	.	Chile
Podoclavella cylindrica	.		.	.	.	.	.	.	.	.	.	W. and S. Australia
P. kottae sp.n.	.	.	.	.	.	.	.	.	.	.	+	.
Clavelina claviformis	.	.	.	.	.	.	.	.	.	.	+	E. Australia
Sycozoa sigillinoides	+	+	.	+	.	.	+	+	+	+	.	Southern Australia
S. georgiana	.	.	.	.	+	?+	.	.	.	.	.	.
S. anomala sp.n.	.	.	.	.	.	.	.	.	.	.	+	.
Distaplia colligans	.	.	.	+	+	.	.	.	.	.	.	.
D. cylindrica	+	+	.	.	+	+	+	+	.	.	.	.
Hypsistozoa fasmeriana	.	.	.	.	.	.	.	.	.	.	+	.
Cystodytes dellechiajei	.	.	.	.	.	.	+	.	.	.	+	Widely distributed in warm waters of the world
C. dellechiajei f. *antarctica*	.	+	.	.	.	.	.	.	.	.	.	.
Atapozoa marshi	.	.	.	.	.	.	.	.	.	.	+	Western Australia
Tylobranchion speciosum	+	+	+	.	+	+	+	.	.	.	.	.
Ascidia translucida	.	.	.	.	+	.	.	.	+	.	.	.
A. challengeri	+	+	+	+	+	.	.	.	+	.	.	Bass Strait
A. interrupta	.	.	.	.	.	.	.	.	.	.	.	East coast tropical America; West Africa

Table 38 (*cont.*)

Species	*Antarctic Continent (excluding Graham Land)*	*Graham Land*	*South Shetlands*	*South Orkneys*	*South Georgia and Shag Rocks*	*South Sandwich Islands*	*Falkland Islands and Patagonian Shelf*	*Magellan region and Tierra del Fuego*	*Kerguelen*	*Campbell, Auckland and Macquarie Islands*	*New Zealand*	*Further distribution*
A. sydneiensis	.	.	.	.	.	.	.	.	.	.	.	Widely distributed; warm and temperate waters of the world
Agnesia glaciata	.	.	.	.	.	.	.	+	.	.	+	South Africa
Caenagnesia bocki	+	+	.	.	+	.	.	.	.	.	.	.
Corella eumyota	+	+	.	.	.	.	+	+	.	+	+	South Africa; St. Paul; South West Australia; Tasmania
?Botryllus separatus	.	.	.	.	.	.	.	.	.	.	+	Indonesia
Polyzoa opuntia	.	.	.	.	+	.	+	+	+	.	.	Heard Island
P. reticulata	.	.	.	.	+	.	+	+	+	+	.	.
Alloeocarpa incrustans	.	.	.	.	+	.	+	+	.	.	.	.
Amphicarpa diptycha	.	.	.	.	.	.	.	.	.	.	.	Western and Southern Australia; Tasmania
Cnemidocarpa pfefferi	.	.	+	.	+	.	.	.	.	.	.	.
C. nordenskjöldi	.	.	.	.	.	.	+	+	.	.	.	.
C. drygalskii	+	+	.	.	.	.	.	.	.	.	.	.
C. verrucosa	+	+	+	.	+	+	+	.	+	.	.	.
C. tricostata sp.n.	.	.	.	.	+	.	.	.	.	.	.	.
Styela schmitti (including f. *simplex*)	.	.	.	.	.	.	.	+	.	.	.	Off Uruguay, South America
S. insinuosa	+	.	+	.	+	.	.	.	.	.	.	.
S. magalhaensis	+	.	.	.	+	.	.	+	.	.	.	?South coast Chile; south coast Argentine
S. paessleri	.	.	.	.	.	.	+	+	.	.	.	.
S. partita	.	.	.	.	.	.	.	.	.	.	.	Warm Atlantic American coast; English Channel to West Africa; Mediterranean; Ascension Island; Japan
Pyura stolonifera	.	.	.	.	.	.	.	.	.	.	.	South Africa; South Australia; Tahiti
P. setosa	+	+	.	+	.	.	.	.	.	.	.	.
P. discoveryi	+	+	+	.	+	.	.	.	.	.	.	.
P. squamata	+	+	.	.	.	.	.	.	.	.	.	.
P. legumen	.	.	.	.	.	.	+	+	.	.	.	.
P. georgiana	.	.	.	.	+	.	.	.	.	.	.	North coast Argentine
P. bouvetensis	?+	+	+	.	.	.	.	.	.	.	.	Bouvet Island
P. jacatrensis	.	.	.	.	.	.	.	.	+	+	.	Indonesia; West Australia; Tasmania; Marion Island
P. vittata	.	.	.	.	.	.	.	.	.	.	.	Warm East Atlantic coast America; West Africa; Japan; Ascension Island
Herdmania momus	.	.	.	.	.	.	.	.	.	.	.	Widely spread in warm waters of the world

Table 38 (*cont.*)

Species	*Antarctic Continent (excluding Graham Land)*	*Graham Land*	*South Shetlands*	*South Orkneys*	*South Georgia and Shag Rocks*	*South Sandwich Islands*	*Falkland Islands and Patagonian Shelf*	*Magellan region and Tierra del Fuego*	*Kerguelen*	*Campbell, Auckland and Macquarie Islands*	*New Zealand*	*Further distribution*
Bathypera splendens	+	+	.	.	.	.	.	.	.	.	.	.
Molgula pedunculata	+	+	.	.	+	.	.	.	+	.	.	.
M. falsensis	.	.	.	.	.	.	.	.	.	.	.	South Africa
M. platei	.	.	.	.	.	.	.	.	.	.	.	Coastal waters of Chile
M. malvinensis	.	.	.	.	+	.	+	.	+	+	.	.
M. bacca	+	+	.	.	.	.	.	.	.	.	.	.
M. setigera (including forms)	.	.	.	.	+	.	+	.	.	.	.	Marion Island
M. sabulosa	.	.	.	.	.	.	.	.	.	.	.	South Australia; Indonesia
Ascopera gigantea	+	+	.	.	+	+	.	.	+	.	.	?Bouvet Island
Paramolgula gregaria	.	.	.	.	+	.	+	+	.	.	.	Coast of Chile
Eugyra kerguelenensis	.	.	.	.	+	.	.	.	+	.	.	Off coast of Argentine
E. brewinae sp.n.	.	.	.	.	.	.	.	.	.	.	+	.
E. ärnbäckae sp.n.	.	.	.	.	.	+	.	.	.	.	.	.

Text-fig. 67 presents the affinities of the ascidian faunas as shown by the species in the 'Discovery' collection, and for comparison the sponge faunas of the same areas based on Burton's (1932) figures.

Most of the species of ascidians found round the main part of the Antarctic continent also occur in the Graham Land region, but progressively fewer in South Georgia, Kerguelen, the Falkland–Patagonian region, and the Campbell–Auckland–Macquarie Islands region.

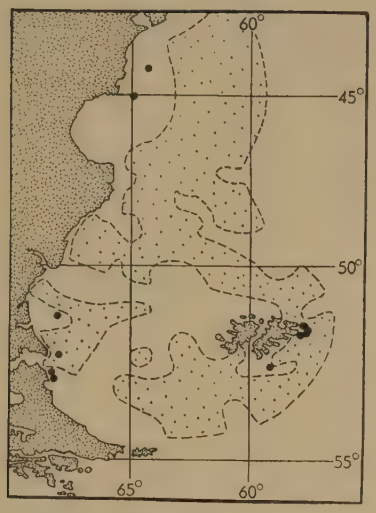
Similarly, amongst the species of the Graham Land region, a high proportion is also known from the rest of the Antarctic continent, and fewer from the remaining regions.

Of the South Georgia species nearly half are also known from the Falkland–Patagonian region and also from Kerguelen, and smaller proportions from elsewhere.

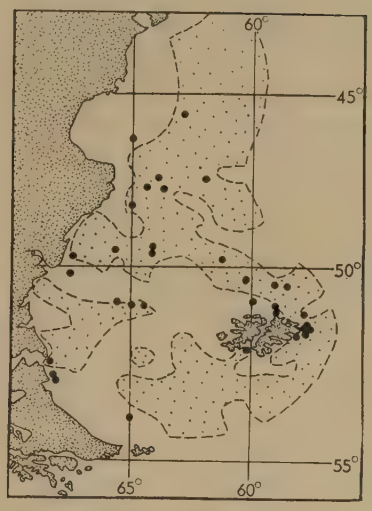
Amongst the species from the Falkland–Patagonian region more than half also occur in South Georgia.

The ascidian faunas therefore show the following affinities. In the high Antarctic the closest ties are between the main part of the continent and the Graham Land region, which is no more than a peninsula projecting into somewhat lower latitudes, but still well south of the Antarctic convergence. The Antarctic continent including Graham Land, shows its closest affinity with South Georgia. The latter region, however, has more species in common with the Subantarctic Falkland–Patagonian region. So far as ascidians are concerned South Georgia occupies a position intermediate between the true Antarctic and the true Subantarctic, a fact probably resulting from the colonization of South Georgia from South America and the Falkland Islands via Burdwood Bank on the one hand and from Graham Land via the South Orkney Islands on the other hand. South Georgia lies in the path of material carried by the West Wind Drift from the southern end of South America and from the northern end of the Graham peninsula.

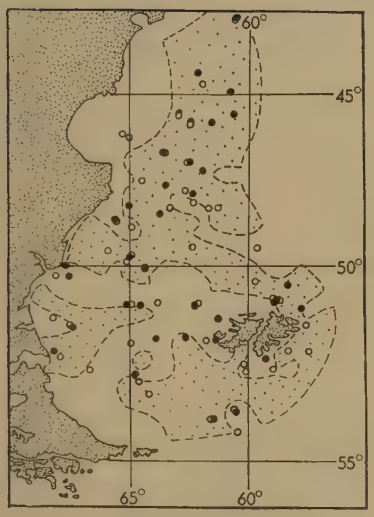
The affinities of the sponge faunas (Text-fig. 67) agree quite well with those shown by the ascidian faunas. But the sponge faunas of South Georgia and the Falkland–Patagonian region have more in common with those of the Antarctic continent (including Graham Land) than is the case in ascidians.



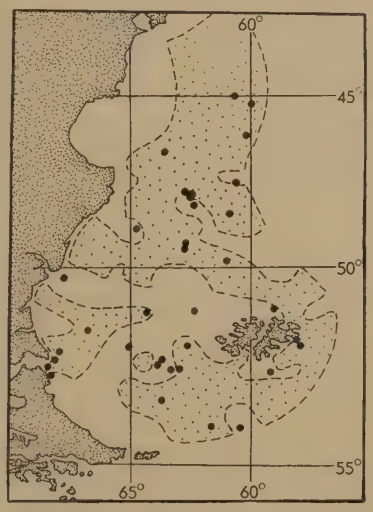
Text-fig. 68



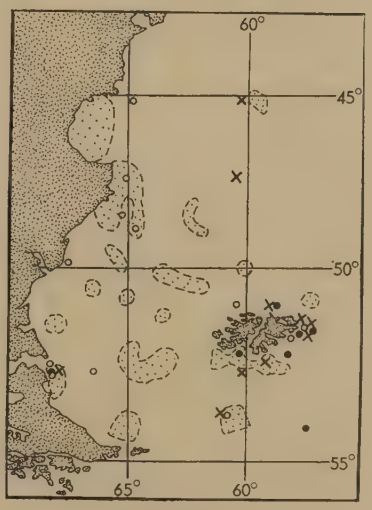
Text-fig. 69



Text-fig. 70



Text-fig. 71



Text-fig. 72

Text-fig. 68. *Pyura legumen* ●. Occurrence on the Patagonian Shelf. Stippled areas indicate the nature of the bottom (after Matthews, 1934), 76–98% fine sand.

Text-fig. 69. *Paramolgula gregaria* ●. Occurrence on the Patagonian Shelf. Stippled areas indicate the nature of the bottom (after Matthews, 1934), 76–98% fine sand.

Text-fig. 70. *Aplidium fuegiense* ○ and *A. falklandicum* ●. Occurrence on the Patagonian Shelf. Stippled areas indicate the nature of the bottom (after Matthews, 1934), 76–98% fine sand.

Text-fig. 71. *Sycozoa sigillinoides* ●. Occurrence on the Patagonian Shelf. Stippled areas indicate the nature of the bottom (after Matthews, 1934), 76–98% fine sand.

Text-fig. 72. *Polyzoa opuntia* ○, *P. reticulata* ● and *Alloeocarpa incrustans* ×. Occurrence on the Patagonian Shelf. Stippled areas indicate the nature of the bottom (after Matthews, 1934), 'large fragments, 15 mm. and over'.

LOCAL DISTRIBUTION

The abundance of some species on the Patagonian Shelf and round the Falkland Islands allows closer investigation of the factors which control their local distribution.

Pyura legumen and *Paramolgula gregaria* are two species of simple ascidian commonly collected in the area. Text-figs. 68 and 69 show the stations at which they were taken. *P. legumen* occurred close to the coast of South America and of the Falkland Islands, but not on the main part of the Patagonian Shelf. *P. gregaria* was found to be widely distributed on the Shelf, occupying not only the main part but also the inshore areas where *P. legumen* occurred.

P. legumen has a stalk and requires for its attachment firm solid objects. Matthews (1934) has shown that such objects are common only in certain areas and are absent over most of the main part of the Shelf, from which we have seen *P. legumen* also to be absent.

P. gregaria is a stalkless species with a broad base and is able to live on a substratum of fine deposits; its presence over a large part of the shelf corresponds to the wide distribution of fine deposits. This explanation of the different occurrence of these two species seems more satisfactory than any based on differences in depth, temperature or water currents.

Most species of the family Polyclinidae live attached to hard substrata, but on the Patagonian Shelf there are species which lie on the surface of the sand only lightly attached or quite free. *Aplidium fuegiense* and *A. falklandicum* may be taken as typical of these, and their wide distribution on the shelf is shown in Text-fig. 70. Most of the records are from stations where the bottom material consists largely of fine sand. *A. fuegiense* is a particularly successful species in the area, to judge from its abundance, and it has a shape modified to suit its habitat. The colony is long and narrow, the expanded base lying slightly embedded in the sand and the tapering distal part floating freely in the water. *A. falklandicum*, with a similar local distribution, sometimes has a similarly shaped colony, but is at least occasionally solidly attached.

In the family Clavelinidae *Sycozoa sigillinoides* has a distribution on the Patagonian Shelf (Text-fig. 71) similar to that of the two polyclinid species. The form of its colony is quite different, however, the heads, which alone contain the zooids, being borne on stalks, but the result is the same, namely the zooids are kept free of the sandy bottom.

Three compound species of the family Styelidae occur in the Patagonian region: *Polyzoa opuntia*, *P. reticulata* and *Alloeocarpa incrustans* (Text-fig. 72). All three species need solid firm objects for attachment and tend to be restricted to coastal waters where such objects are common, or to other areas with gravel and large fragments. *P. opuntia* in particular, which has large heavy colonies of upright habit, and a small basal area, requires a firm substratum. The fact that this species and *Pyura legumen* have similar local distributions may be related to their similar needs in this respect. *Polyzoa reticulata*, unlike *P. opuntia*, forms colonies spreading horizontally over flat surfaces, and the two species, which are closely related, occupy slightly different ecological niches.

GEOGRAPHICAL SPECIATION

Among Antarctic and Subantarctic ascidians there are several instances of geographical speciation. In some cases the process has led to the complete separation of species, each species occupying a different region. An example of this is the group of closely related species *Pyura legumen*, *P. georgiana* and *P. bouvetensis*. Anatomical features show *P. georgiana* and *P. bouvetensis* to be a pair of closely related species and *P. legumen* to be more distantly related to both. The common ancestor of all three species probably first split into a Subantarctic population which became *P. legumen* and an Antarctic population which later divided into *P. georgiana* and *P. bouvetensis*. The geographical separation of

the three species now seems to be complete, although they occupy adjacent areas. Ecological differences also exist and the percentage distribution of the 'Discovery' specimens at different depths is given in Table 39, showing that the more southern species inhabit progressively greater depths.

Table 39

	Depth (metres)			
	0–100	100–200	*More than* 200	
P. legumen	100	0	0	Percentage distribution
P. georgiana	18	64	18	
P. bouvetensis	0	12	88	

The same family provides another example of geographical speciation. *Pyura stubenrauchi* and *P. setosa* appear to represent respectively the Subantarctic and Antarctic species derived from a common stock, and their geographical ranges do not overlap.

In the family Styelidae there are also instances of the same process. The little-known species *Styela schmitti* shows slight but apparently constant structural differences in specimens from Montevideo and from Cape Horn, which I believe to represent geographical forms. As the species has been collected only twice, however, it is not possible to say with certainty whether its distribution is continuous, with the observed anatomical differences representing different points of a cline, or whether it is discontinuous with separate geographical subspecies.

I have already mentioned the difficulty of deciding if *Cnemidocarpa nordenskjöldi* and *C. drygalskii* are different species. If they are, and I have given reasons for thinking them to be separate, they constitute a pair of very closely related species, one species occurring only in the Subantarctic and the other only in the Antarctic.

The family Molgulidae, as represented in the 'Discovery' collections, gives one example of populations of a species from different areas showing structural differences. This is *Molgula setigera*, with distinct forms from South Georgia and Marion Island and the typical form from the Falkland Islands.

Conditions in the Antarctic and Subantarctic seem to have favoured the geographical speciation of ascidians. The same has been found in other groups (see Ekman, 1953), and has been explained by the long geological isolation of the Antarctic Continent. The position of the Antarctic Convergence, coinciding as it does with the barrier formed by deep water, must have been effective in maintaining the separation of populations upon which geographical speciation depends.

The presence of isolated islands near the Antarctic Convergence also encourages the breaking up of populations into groups which become genetically isolated as subspecies or species.

THE SIZE OF SOUTH POLAR ASCIDIANS

The size attained by an ascidian depends mainly on the water temperature and the food supply. In a species adapted to cold water it is the food supply which limits growth. Ascidians feed largely on plankton, which is abundant in Antarctic waters, so it is probable that the rich phytoplankton is the primary cause of the large size which certain south polar species attain.

A survey of the 'Discovery' material gives little evidence of an increase in the size of specimens of one species from areas nearer the south pole. In fact not many species cross the Antarctic Convergence so it is difficult to find species in which this tendency might appear. *Aplidium circumvolutum*, however, does increase in size towards the pole. But in *Distaplia cylindrica*, which occurs in both the Subantarctic and the Antarctic, almost equally large specimens were taken from South Georgia and the Patagonian Shelf.

Closely related species inhabiting the Subantarctic and the Antarctic also show no clear case of greater size in more southern species. *Cnemidocarpa nordenskjöldi* and *C. drygalskii*, for example, attain about the same size.

Pyura legumen, *P. georgiana* and *P. bouvetensis* inhabit progressively more southern waters but also fail to show any corresponding increase in body size, although there is a striking increase in the length of the stalk.

It is true, however, that the Subantarctic and Antarctic species of a family are often considerably larger than the temperate and tropical species of the same family. This is particularly noticeable in *Distaplia cylindrica* and in the molgulids *Paramolgula gregaria* and *Ascopera gigantea*.

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PLATE I

Fig. 1. *Aplidium circumvolutum* (Sluiter). St. WS 856. × 1.
Fig. 2. *A. fuegiense* Cunningham. St. WS 797. × ½.
Fig. 3. *A. falklandicum* sp.n. St. WS 72. × ⅓.
Fig. 4. *A. falklandicum* sp.n. Holotype. St. WS 73. × ⅔.
Fig. 5. *A. radiatum* (Sluiter). St. 190. × ½.
Fig. 6. *Synoicum adareanum* (Herdman). St. 1660. × ½.
Fig. 7. *S. georgianum* Sluiter. St. 140. × ⅔.
Fig. 8. *S. giardi* (Herdman). St. MS 64. × 1.
Fig. 9. *S. kuranui* Brewin. St. 935. × ½.
Fig. 10. *Protopolyclinum pedunculatum* sp.n. St. 934. × ⅓ approx.

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PLATE II

Fig. 1. *Podoclavella kottae* sp.n. St. 934. A group of stalks, three with the body of the zooid at the top of the stalk. $\times \frac{3}{5}$ approx.

Fig. 2. *Clavelina claviformis* (Herdman). St. 929. $\times \frac{3}{8}$.

Fig. 3. *Sycozoa sigillinoides* Lesson. St. WS 765. Branched colony with thick basal stem bearing several stalks with and without a head. $\times \frac{3}{4}$.

Fig. 4. *S. sigillinoides* Lesson. St. WS 765. Branched colony with basal stem bearing stalks with mature heads. The apical parts of some heads are clear and lack zooids. $\times \frac{3}{4}$.

Fig. 5. *S. sigillinoides* Lesson. St. WS 244. Branched colony with headless stalks. $\times \frac{1}{2}$.

Fig. 6. *S. sigillinoides* Lesson. St. 1230. Branched colony of 'umbellata' type. $\times \frac{3}{4}$.

Fig. 7. *S. sigillinoides* Lesson. St. WS 237. Stalk with several regenerating heads. $\times \frac{3}{4}$.

Fig. 8. *S. sigillinoides* Lesson. St. 145. Unbranched colony. $\times 1\frac{1}{2}$.

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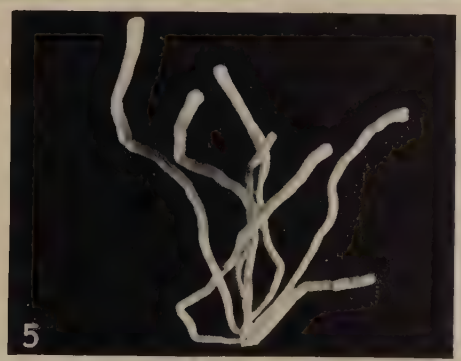
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PLATE III

Fig. 1. *Tylobranchion speciosum* Herdman. St. 144. Two colonies. $\times 1\frac{1}{2}$.

Fig. 2. *Hypsistozoa fasmeriana* (Michaelsen). St. 935. Colony. $\times \frac{23}{20}$.

Fig. 3. *Distaplia colligans* Sluiter. St. 1113. $\times \frac{3}{4}$.

Fig. 4. *D. cylindrica* (Lesson). St. 366. (Scale in cm.)

Fig. 5. *Sycozoa georgiana* (Michaelsen). St. MS 68. $\times 1\frac{1}{2}$.

Fig. 6. *S. anomala* sp.n. St. 929. $\times 1\frac{1}{8}$.

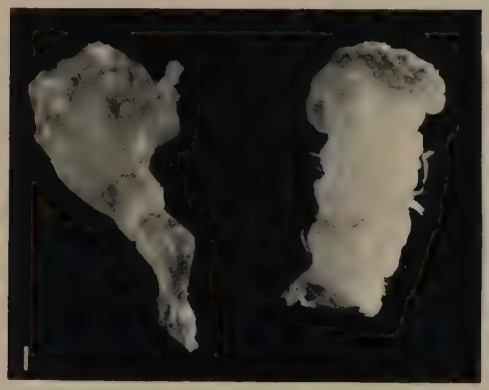
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PLATE IV

Fig. 1. *Pyura discoveryi* (Herdman). St. 27. Right: a single specimen. Left: two specimens growing together. × 1½.

Fig. 2. *P. setosa* (Sluiter). St. 175. Specimen growing on a stone; the test has been damaged at one place. × ⅞.

Fig. 3. *Eugyra ärnbäckae* sp.n. St. 366. Intact specimens. × ¾.

Fig. 4. *Pyura bouvetensis* (Michaelsen). St. 1952. Specimen with thin papery test. × ¾.

Fig. 5. *P. bouvetensis* (Michaelsen). St. 181. Specimen with leathery wrinkled test. × ¾.

Fig. 6. *P. legumen* (Lesson). St. 52. × ¾ approx.

Fig. 7. *P. georgiana* Michaelsen. St. 123. × ¾.

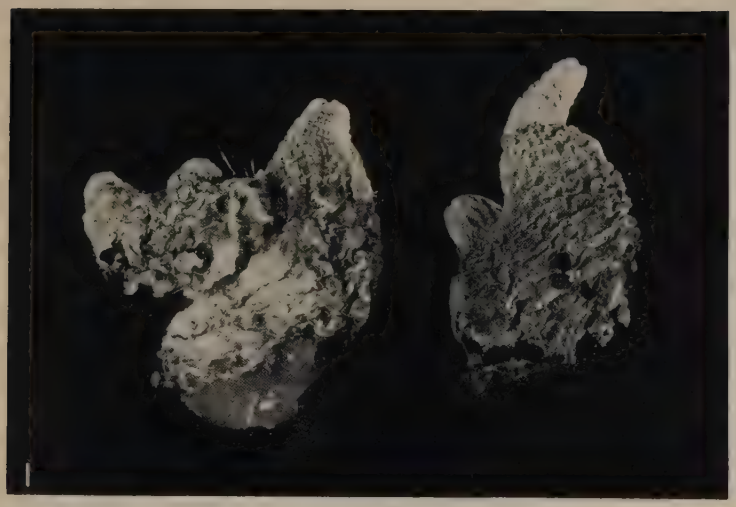
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PLATE V

Fig. 1. *Polyzoa opuntia* Lesson. Shore Collection, Cumberland Bay, S. Georgia. $\times \frac{3}{8}$.

Fig. 2. *Paramolgula gregaria* (Lesson). St. WS 71. Two large specimens. $\times \frac{3}{8}$.

Fig. 3. *Amphicarpa diptycha* (Hartmeyer). St. 1686. Colony on a mussel shell. $\times \frac{3}{4}$.

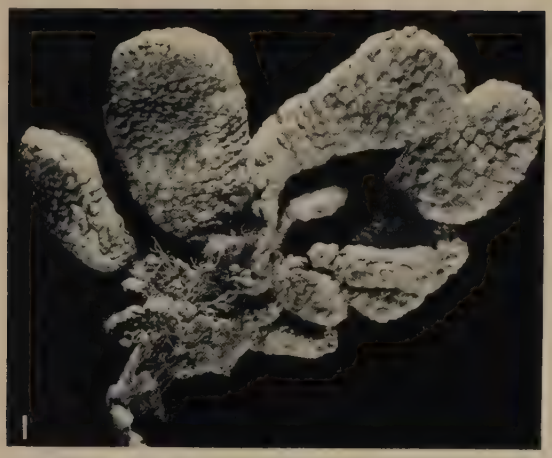
Fig. 4. *Molgula pedunculata* Herdman. Sts. 27, 123. $\times \frac{3}{4}$ approx.

Fig. 5. *Cnemidocarpa verrucosa* (Lesson). St. 366. A group of individuals with several specimens of *Ascopera gigantea* Herdman. $\times \frac{3}{8}$.

Fig. 6. *Polyzoa reticulata* (Herdman). St. WS 71. $\times 1\frac{1}{2}$.

Fig. 7. *Molgula platei* Hartmeyer. St. WS 742. $\times \frac{3}{4}$

Fig. 8. *Alloeocarpa incrustans* (Herdman). St. 388. Three colonies, one on a lamellibranch shell. $\times \frac{3}{4}$.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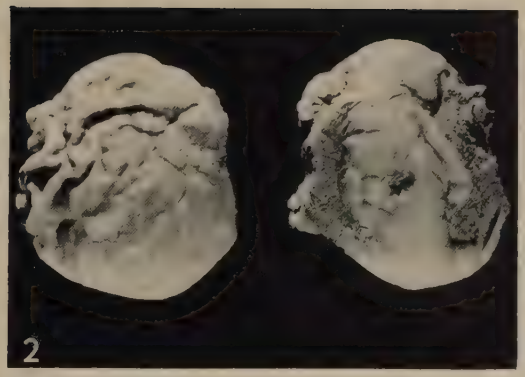
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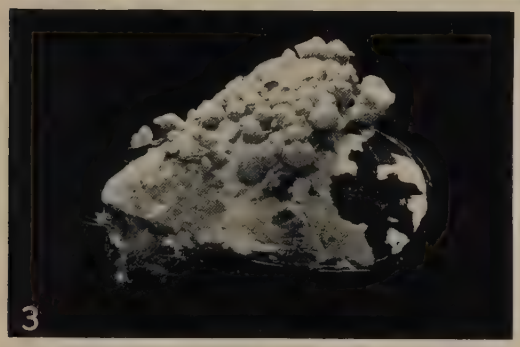
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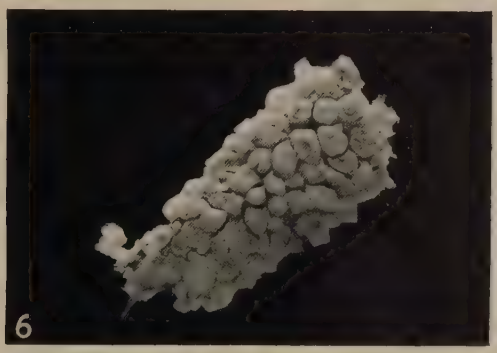
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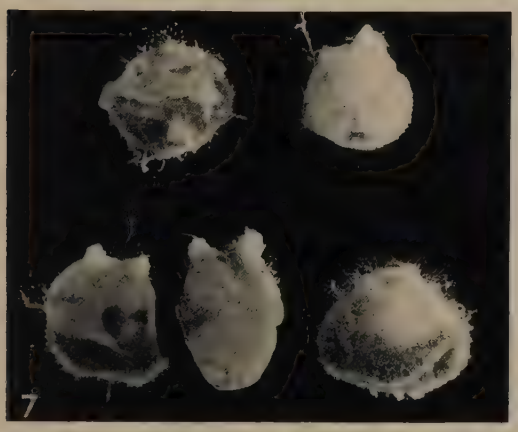
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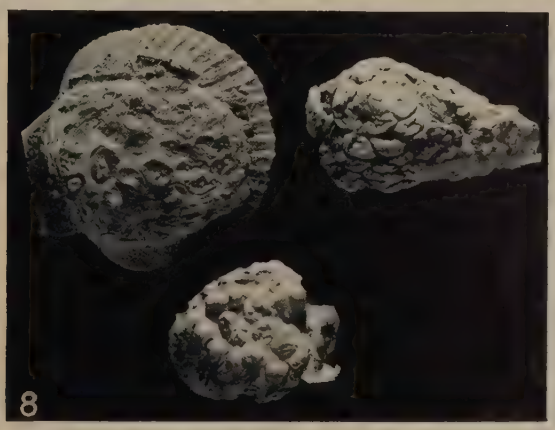
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PLATE VI

Fig. 1. *Ascopera gigantea* Herdman. St. MS 68. Long-stalked specimens from S. Georgia. $\times \frac{3}{8}$.

Fig. 2. *A. gigantea* Herdman. Deception Island. Short-stalked specimens. $\times \frac{3}{8}$.

Fig. 3. *Distaplia cylindrica* (Lesson). Photomicrograph $\times 60$. Contents of intestine, with a few small sand grains and many small food particles.

Fig. 4. *D. cylindrica* (Lesson). Photomicrograph $\times 25{\cdot}5$. Zooid stained in eosin and cleared to show large sand grains in branchial sac but none in oesophagus, stomach, intestine or rectum. The dark mass in the intestine is an accumulation of small food particles.

Fig. 5. *D. cylindrica* (Lesson). Photomicrograph $\times 60$. Contents of branchial sac with many large sand grains.

Fig. 6. *Eugyra ärnbäckae* sp.n. Photomicrograph $\times 45$. Contents of branchial sac with many large sand grains.

Fig. 7. *E. ärnbäckae* sp.n. Photomicrograph $\times 45$. Contents of stomach with many food particles, some quite large, but no large sand grains.

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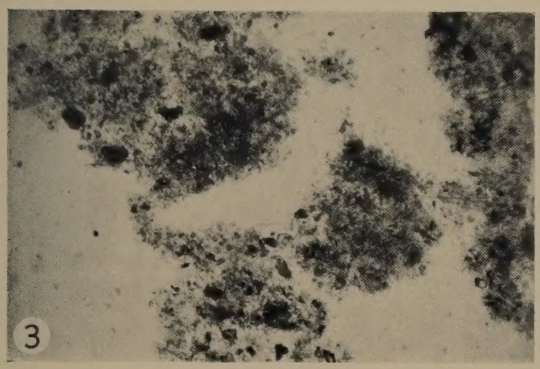
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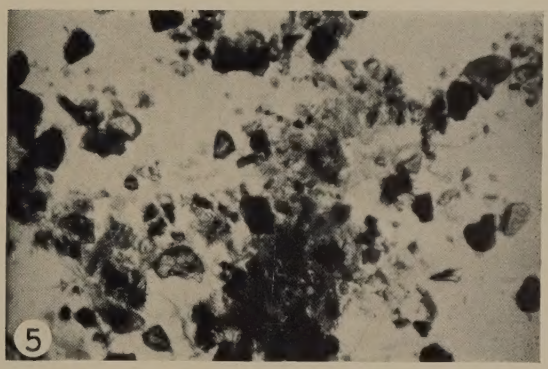
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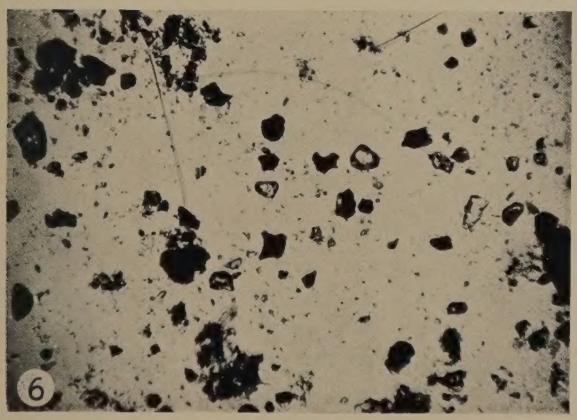
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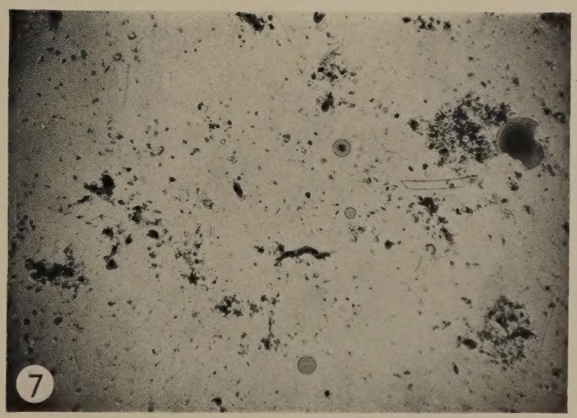
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